8.87), which was isomerized with alkali. The resulting iso-compound, without purification, was pyrolyzed giving a small yield of 4-chloro-7-hydroxyphthalide, m.p. 155–157°, which was identified by comparison with a known sample prepared by an unambiguous synthesis reported by Boothe, *et al.*, in an accompanying communication.[10]

(10) J. H. Boothe, A. Green, J. P. Petisi, R. G. Wilkinson and C. W. Waller, THIS JOURNAL, **79**, 4564 (1957).

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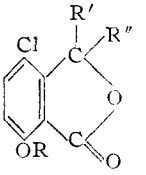
RECEIVED AUGUST 1, 1957

DEMETHYLTETRACYCLINES. SYNTHESIS OF A DEGRADATION PRODUCT

Sir:

In an accompanying communication[1] there is described a new series of antibiotics closely related to the tetracyclines, both in antibacterial activity and in structure. In a second accompanying communication[2] evidence has been presented that these new antibiotics differ from the parent compounds only in that they lack a methyl group at the 6-position of the tetracycline nucleus.

We now wish to report the synthesis of a degradation product which proves that the arrangement of substituents in the D ring and in portions of the C ring of demethylchlorotetracycline is the same as in chlorotetracycline except for the C-6 methyl group. This compound is 4-chloro-7-hydroxyphthalide (R = R′ = R″ = H) which is analogous to 4-chloro-7-hydroxy-3-methylphthalide (R = R′ = H, R″ = CH_3), obtained by the same degradative route from chlorotetracycline.[3]



The starting point for the synthesis is 4-chloro-3-hydroxy-7-methoxy-3-methylphthalide (R = R′ = CH_3, R″ = OH) whose synthesis has already been reported from this laboratory.[4] This compound was oxidized with potassium permanganate in 0.5 *N* sodium hydroxide at 90° for one hour to yield the 4-chloro-3-hydroxy-7-methoxyphthalide-3-carboxylic acid (R = CH_3, R′ = OH, R″ = COOH) in 67% yield. This compound has been isolated as a degradation product of chlorotetracycline and was named there as the tautomeric keto-acid, 6-chloro-3-methoxyphthalonic acid.[5] The reduction of this compound with sodium borohydride in *N* sodium hydroxide yielded 4-chloro-7-methoxyphthalide-3-carboxylic acid (R = CH_3, R′ = H, R″ = COOH) in 90% yield; m.p. 175–176° with effervescence; $\lambda_{max}^{0.1\,N\,HCl}$ 216 mμ (ε 32,200); 240 mμ (ε 8,240); 313 mμ (ε 5,220). $\lambda_{max}^{0.1\,N\,NaOH}$ (after standing one hour)[6] 214 mμ (ε 31,500); 285 mμ (ε 2,190).

Anal. Calcd. for $C_{10}H_7O_5Cl$: C, 49.5; H, 2.9; Cl, 14.6. Found: C, 49.5; H, 3.2; Cl, 14.8.

The phthalidecarboxylic acid was then decarboxylated by heating 5–10 minutes just above its melting point to yield 4-chloro-7-methoxy-phthalide (R = CH_3, R′ = R″ = H) which was sublimed at 175° (760 mm.); yield, 70%; m.p. 167–168° $\lambda_{max}^{0.1\,N\,HCl}$ 215 mμ (ε 37,300); 236 mμ (ε 8,830); 308 mμ (ε 4,560); $\lambda_{max}^{0.1\,N\,NaOH}$ (after standing one hour)[6] 286 mμ (ε 2,190).

Anal. Calcd. for $C_9H_7O_3Cl$: C, 54.4; H, 3.6; Cl, 17.9. Found: C, 54.8; H, 3.7; Cl, 17.7.

The methyl ether was cleaved by refluxing in 48% hydrobromic acid for 2.5 hours. The product, 4-chloro-7-hydroxyphthalide (R = R′ = R″ = H), crystallized from the hydrobromic acid on cooling in 70% yield and was then sublimed at 100° (15–20 mm.). The m.p. was 158–159° and there was no depression upon admixture with the degradation product.[2] The ultraviolet and infrared spectra were identical; $\lambda_{max}^{0.1\,N\,HCl}$ 235 mμ (ε 8,400); 308 mμ (ε 4,150); $\lambda_{max}^{0.1\,N\,NaOH}$ 254 mμ (ε 8,400); 343 mμ (ε 6,180).

Anal. Calcd. for $C_8H_5O_3Cl$: C, 52.1; H, 2.7; Cl, 19.2. Found: C, 52.2; H, 3.2; Cl, 19.0.

(1) J. R. D. McCormick, N. O. Sjolander, U. Hirsch, E. R. Jensen and A. P. Doerschuk, THIS JOURNAL, **79**, 4561 (1957).

(2) J. S. Webb, R. W. Broschard, D. B. Cosulich, W. J. Stein, and C. F. Wolf, *ibid.*, **79**, 4563 (1957).

(3) C. R. Stephens, L. H. Conover, R. Pasternack, F. A. Hochstein, W. T. Moreland, P. P. Regna, F. J. Pilgrim, K. J. Brunings and R. B. Woodward, *ibid.*, **76**, 3568 (1954).

(4) J. H. Boothe, S. Kushner, J. P. Petisi and J. H. Williams, *ibid.*, **75**, 3261 (1953).

(5) B. L. Hutchings, C. W. Waller, S. Gordon, R. W. Broschard, C. F. Wolf, A. A. Goldman and J. H. Williams, *ibid.*, **74**, 3710 (1952). For a discussion of and references to this type of tautomerism see ref. 4.

(6) Upon standing in 0.1 *N* sodium hydroxide for an hour or less the long wave length absorption maximum undergoes a hypsochromic shift which is reversible by acidification. This is assumed to be attributable to the opening and closing of the lactone ring and will be dealt with in more detail in a subsequent publication.

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RECEIVED AUGUST 1, 1957

α,α′-DIGLYCEROPHOSPHATE IN PLANTS

Sir:

We have observed a P^{32}-labeled compound in hydrolysates of *Scendesmus* phosphatides which contained more than a third of the lipid phosphorus. The same phosphate ester also possessed as much as 90% of the alcohol-soluble non-lipid phosphorus of *Scenedesmus* cultured at low light intensity in media containing P^{32}. The cellular concentration of the ester, calculated from its P^{32} activity and the nutrient specific activity, was as high as 10^{-3} *M*. The same compound in lower concentrations occurred in the only two species of higher plants (clover) tested. It was isolated by chromatography on Whatman No. 1 paper with R_f = 0.36 in phenol–water and R_f = 0.11 in butanol–propionic acid–water.[1] These R_f values correspond to those recorded by Dawson[2] for an unknown in rat liver extracts.

(1) A. A. Benson, J. A. Bassham, M. Calvin, T. C. Goodale, V. A. Haas and W. Stepka, THIS JOURNAL, **72**, 1710 (1950).

(2) R. M. C. Dawson, *Biochim. et Biophys. Acta*, **14**, 374 (1954).