Manganese-dioxide oxidation of the synthetic 11-mono-*cis* isomer yielded the corresponding aldehyde. The product of this reaction was identified as neoretinene b by Prof. George Wald[10] through its condensation with opsin to yield rhodopsin.

(10) Biological Laboratories, Harvard University, Cambridge, Mass.

ORGANIC CHEMISTRY DIVISION
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RECEIVED MARCH 23, 1956

A NEW INOSAMINE FROM AN ANTIBIOTIC

Sir:

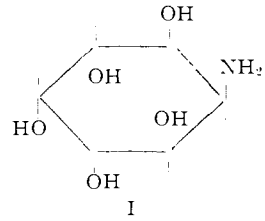
The occurrence of non-synthetic amino analogs of inositol ("inosamines")[1] has been reported only in the case of the streptomycin[2] and neomycin[3] families of antibiotics; in each case the compound was a diamine.

We have isolated a *mono*-inosamine having a configuration unprecedented in natural inositols. By hydrolysis of a new antibiotic (designated in these laboratories as 1703–18B[4]) with concentrated hydrochloric acid, we obtained a compound, m.p. 217–221[6] (dec.) (*Anal.* Calcd. for $C_6H_{13}NO_5 \cdot HCl$ (215.6): C, 33.42; H, 6.54; N, 6.50; Cl, 16.44. Found: C, 33.54; H, 6.83; N (Dumas), 6.20; N (Van Slyke), 6.52; Cl, 16.37) which yielded a free base, m.p. 238–240° (dec.) (*Anal.* Calcd. for $C_6H_{13}NO_5$ (179.2): C, 40.22; H, 7.31; N, 7.82. Found: C, 40.40; H, 7.30; N, 7.87).

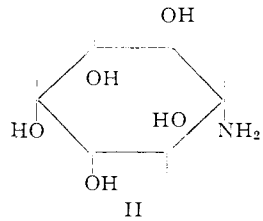
The base consumed 6.14 moles of periodate (inositol, 6.20) with no formaldehyde formation. The optical rotation of the base in water or in aqueous ammonium molybdate[7] was zero; the hexa-acetate, m.p. 277.5–278.5° (*Anal.* Calcd. for $C_{18}H_{25}NO_{11}$ (431.4): C, 50.11; H, 5.84; N, 3.25; acetyl, 59.85. Found: C, 49.88; H, 6.00; N, 3.32; acetyl 58.61) in chloroform was also optically inactive, and the inactive base was recovered from its nicely crystalline salt (m.p. 230–232°) with *d*-camphorsulfonic acid.

The above data show the compound to be a meso-inosamine. Three of the eight possible meso-inosamines have been reported[1,8,9]; the physical properties of the new inosamine do not correspond to those of any of them.

Under the conditions described by Angyal and MacDonald[10] the phthalimido derivative,[11] m.p. 255–261° (dec.) (*Anal.* Calcd. for $C_{14}H_{15}NO_7$ (309.3): C, 54.37; H, 4.89; N, 4.53. Found: C, 54.03; H, 5.08; N, 4.86) of the inosamine furnished a single, racemic *mono*-acetonide, m.p. 210–212° (*Anal.* Calcd. for $C_{17}H_{19}NO_7$: C, 58.45; H, 5.48; N, 4.01. Found: C, 58.23; H, 5.84; N, 3.92) which took up one mole of periodate. Only two structures, I and II, are thus possible for the inosamine.

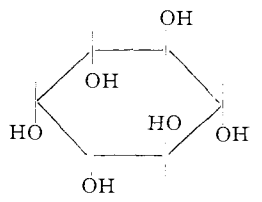


I

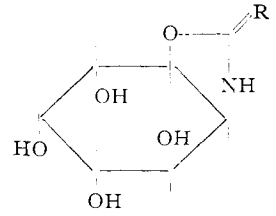


II

Nitrous acid deamination of the inosamine produced the known "meso" inositol III. In the inosamine series this reaction is known to proceed with inversion[12]; therefore, our compound is I.



III



IV, a, R = O
b, R = S

Reaction of the inosamine with carbobenzyloxy chloride provides further evidence for structure I; under appropriate conditions the chief product is the cyclic carbamate IVa, m.p. 203–205° (*Anal.* Calcd. for $C_7H_{11}NO_6$ (205.2): C, 40.97; H, 5.40; N, 6.83. Found: C, 41.20; H, 5.56; N, 6.81). The carbamate consumed 2.92 moles of periodate (mannitol standard, 5.00), as required for structure IVa. Similarly, the thiocarbamate IVb, m.p. 245° (dec.) is produced by reaction of I with phenyl isothiocyanate.[8b,13] (*Anal.* Calcd. for $C_7H_{11}NSO_5$ (221.2): C, 37.99; H, 5.01; N, 6.33; S, 14.49. Found: C, 38.16; H, 5.23; N, 6.37; S, 14.68).

We believe that this constitutes the first occurrence of a mono-inosamine and of a cyclitol of this configuration. The structure of antibiotic 1703–18B will be the subject of a future publication.

(1) H. E. Carter, R. K. Clarke, B. Lytle and G. E. McCasland, *J. Biol. Chem.*, **175**, 683 (1943).

(2) (a) H. E. Carter, *et al.*, *Science*, **103**, 53 (1946); (b) J. Fried, A. Boyak and O. Wintersteiner, *J. Biol. Chem.*, **162**, 393 (1946); (c) R. L. Peck, *et al.*, THIS JOURNAL, **68**, 776 (1946).

(3) F. A. Kuehl, M. N. Bishop and K. Folkers, *ibid.*, **73**, 881 (1951).

(4) On the basis of published data[5] it appears that this antibiotic is similar to hygromycin, although not identical with it.

(5) R. L. Mann, R. M. Gale and F. R. van Abeele, *Antibiotics and Chemotherapy*, **3**, 1279 (1953).

(6) All melting points were determined on the Kofler hot stage and are corrected.

(7) W. W. Pigman and R. M. Goepp, Jr., "Chemistry of the Carbohydrates," Academic Press, New York, N. Y., 1948, p. 248.

(8) (a) L. Anderson and H. A. Lardy, THIS JOURNAL, **72**, 3141 (1950); (b) G. E. McCasland, *ibid.*, **73**, 2295 (1951).

(9) (a) J. M. Grosheintz and H. O. L. Fischer, *ibid.*, **70**, 1479 (1948); (b) H. D. Orloff, *Chem. Revs.*, **54**, 347 (1954).

(10) S. J. Angyal and C. G. MacDonald, *J. Chem. Soc.*, 686 (1952).

(11) We are indebted to Dr. B. R. Baker for suggesting this derivative for the purpose.

(12) (a) T. Posternak, *Helv. Chim. Acta*, **33**, 1597 (1950); (b) H. Straube-Rieke, H. A. Lardy and L. Anderson, THIS JOURNAL, **75**, 694 (1953).

(13) M. Roux, *Ann. Chim.*, [8] **1**, 112 (1904). The question of tautomeric forms is immaterial to our argument.

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IDENTIFICATION OF ENZYMATICALLY ACTIVE SULFATE AS ADENOSINE-3′-PHOSPHATE-5′-PHOSPHOSULFATE[1]

Sir:

DeMeio's pioneering work has shown that enzymatic sulfate activation is an ATP-linked reac-

(1) This investigation was supported by research grants from the Cancer Institute of the National Institutes of Health, Public Health Service, and the Life Insurance Medical Research Fund.