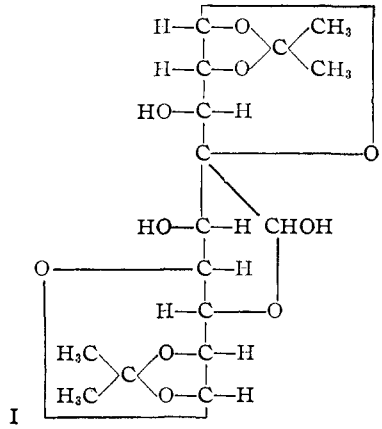
tion of suitable raw materials, branched-chain sugars containing from 8 to 14 carbon atoms may be prepared. A variety of sugar derivatives having from 4 to 7 carbon atoms is being investigated. The results are illustrated with 5-aldo-1,2-*O*-isopropylidene-D-*xylo*-pentofuranose[7,8] (6 g. in 500 ml. of lime water), which gave a product, I, in 30% yield after 20 hr. at room temperature; compound I gradually decomposes above 235°; $[\alpha]^{24}D$ + 55.6° (*c* 1, water) at equilibrium; calculated molecular weight is 376 and a value of 374 was found in formamide. *Anal.* Calcd. for $C_{16}H_{24}O_{10}$: C, 51.1; H, 6.4. Found: C, 50.8; H, 6.5.



I

Structure I has been assigned to the product from the following: one mole of I reacted with only one mole of alkaline iodine; but after acid hydrolysis the resulting monobasic acid dialdehyde reacted with two more moles of hypoiodite per mole. Thus I is a branched-chain trialdehyde. I shows no carbonyl absorption in the infrared. On acetylation, only three acetyl groups are introduced. On reduction with sodium borohydride, followed by acetylation, four hydroxyl groups are substituted. I therefore has two free hydroxyl groups and a third in a hemiacetal ring. Mild acid readily removes one isopropylidene group from I. Partial oxidation of this product with periodate, followed by hydrolysis and separation of D-glucuronic acid, establishes the branching point to be at carbon atom 4 and, furthermore, establishes the configurations of carbon atoms 5 to 8. In forming I by an aldol condensation, no change in configuration of carbon atoms 1 to 3 of the starting material seems probable; hence those of carbon atoms 1 to 3 and 7 to 9 of the product are known. No evidence is yet available for assigning the configuration at carbon atom 4. A systematic name for the decose derivative is 9-aldo-4-*C*-formyl-1,2:8,9-di-*O*-isopropylidene-L-*xylo*-L-*altro*-(or L-*xylo*-L-*ido*)-nono-1,4:6,-9-difurano-4(1′),7-pyranose. This work will be described in detail in a forthcoming publication.

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(7) K. Iwadare, *Bull. Chem. Soc. Japan*, **16**, 40 (1941).

(8) R. Schaffer and H. S. Isbell, THIS JOURNAL, **79**, 3864 (1957), have characterized the crystalline product as a dimer, bis-(5-aldo-1,2-*O*-isopropylidene-D-*xylo*-pentofuranose)-3,5′:5′,5-cyclic acetal.

TERNARY OXIDES OF TETRAVALENT MOLYBDENUM

Sir:

In two recent publications[1,2] in THIS JOURNAL McCarroll, Katz and Ward present the results of work on the characterization and the crystal structure of ternary oxides of tetravalent molybdenum of the type $A_2Mo_3O_8$ (A = Mg^{+2}, Zn^{+2}, Co^{+2}, etc.). In the second of these publications[2] the authors state that "no ternary oxides of tetravalent molybdenum were known until Scholder, Klemm and Brixner[3,4] reported the preparation of the compounds $BaMoO_3$, $SrMoO_3$, $CaMoO_3$ and $MgMoO_3$." As the formulation of this statement is rather categorical, it should be pointed out that it is not entirely correct.

Seventy years ago Muthmann[5] in a paper on lower molybdenum oxides made a special section[6] devoted to "Verbindungen des Molybdändioxyds mit Basen" in which he describes the preparation, properties and composition of two compounds of exactly the type discussed by McCarroll, *et al.*, *viz.*, $Zn_2Mo_3O_8$ and $Mg_2Mo_3O_8$. Muthmann's paper is cited by Gmelin.[7]

(1) W. H. McCarroll, R. Ward and L. Katz, THIS JOURNAL, **78**, 2910 (1956).

(2) W. H. McCarroll, L. Katz and R. Ward, *ibid.*, **79**, 5410 (1957).

(3) R. Scholder and W. Klemm, *Angew. Chem.*, **66**, 467 (1954).

(4) R. Scholder and L. Brixner, *Z. Naturforsch.*, **10b**, 178 (1955).

(5) W. Muthmann, *Ann. Chem. Liebigs*, **238**, 108 (1887).

(6) Ref. 5, pp. 134–137.

(7) "Gmelins Handbuch der anorganischen Chemie," System-Nr. 53: Molybdän, 8 Aufl., Verlag Chemie G. m. b. H., Berlin, 1935, pp. 288 and 298.

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THE MECHANISM OF FORMATE ACTIVATION[1]

Sir:

The formation of N^{10}-formyltetrahydrofolic acid[2] ($f^{10}FH_4$) from formate, ATP and FH_4 according to equation 1 was first observed with pigeon liver preparations,[3,4] and later encountered during a study of formiminoglycine degradation by extracts of *Clostridium cylindrosporum*.[5] The mechanism of

$$HCOOH + ATP + FH_4 \longrightarrow f^{10}FH_4 + ADP + P_i \quad (1)$$

this reaction has now been investigated with an enzyme, the formate activating enzyme (also

(1) This investigation was supported by the Atomic Energy Commission (contract No. AT(45-1)-173), the Institutional Grant to the University of Washington by the American Cancer Society, the Life Insurance Medical Research Fund and the United States Public Health Service (Grant No. CY-3310).

(2) The following abbreviations will be used: FH_4, 5,6,7,8-tetrahydrofolic acid; $f^{10}FH_4$, N^{10}-formyltetrahydrofolic acid; $f^{5\text{-}10}FH_4$, N^5,N^{10}-methenyltetrahydrofolic acid; FH_4-P, a phosphorylated derivative of tetrahydrofolic acid (position of the phosphate group not specified); DPN and DPNH, oxidized and reduced diphosphopyridine nucleotide; ATP and ADP, adenosine tri- and di-phosphates; Pi, inorganic phosphate; TRIS, tris-(hydroxymethyl)-aminomethane.

(3) G. R. Greenberg, *Federation Proc.*, **13**, 745 (1954).

(4) G. R. Greenberg, L. Jaenicke and M. Silverman, *Biochim. et. Biophys. Acta*, **17**, 589 (1955).

(5) J. C. Rabinowitz and W. E. Pricer, Jr., THIS JOURNAL, **78**, 4176 (1956).