

LITHIUM DIMETHYL CUPRATE CLEAVAGE OF DIASTEREOMERIC 2,3-ANHYDRO SUGARS

A ROUTE TO 2- and 3-C-METHYL HEX-2-ENOPYRANOSIDES

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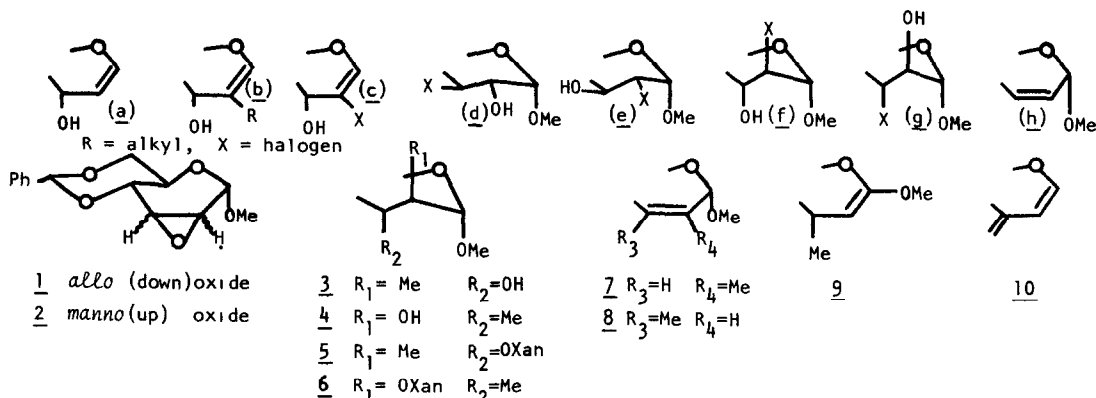
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Projects under way in our laboratory require hex-2-enopyranosides substituted on one of the vinyl carbons with a methyl group. A route involving cleavage of an oxirane with an organo-metallic reagent followed by Chugaev reaction of the derived alcohol, seemed an appropriate route to these substances since (i) the diastereomeric oxiranes 1<sup>1</sup> and 2<sup>2</sup> are readily available, (ii) the preferred geometry of ring opening should lead to the alcohols 3 and 4 respectively, and (iii) the related xanthate esters 5 and 6 should, upon pyrolysis, give 7 and 8 respectively. With 5 the situation is unambiguous but in the case of 6, our faith was founded upon precedents which indicate that of the two available cis-hydrogens<sup>3</sup>, the one alpha to the oxygens (H-1) would be less readily removed in the olefin forming step (iii)<sup>4,5</sup>.

However text-book ring-scissions when applied to the carbohydrate epoxides usually yield



a plethora of aberrant products such as a to h, the "expected" alcohols 3 and 4 being either absent or present in unsatisfactory yields<sup>6,7</sup>. In this communication we wish to report the ready obtainment of the alcohols 3 and 4 and their conversion to the olefins 7 and 8, these compounds and processes being of general interest in the synthesis of branched-chain and other modified sugars.

Formation of the unsaturated products a, b, c is probably attributable to the basicity of methyl lithium. Hence it occurred to us that this difficulty might be overcome by using lithium dimethyl cuprate<sup>8</sup>, which although a good nucleophile is less prone to cause elimination than

methyl lithium<sup>9</sup>, and Johnson's recent report on the virtues of this reagent in oxirane cleavage<sup>10</sup> was additionally encouraging. Accordingly compound 1 reacted with lithium dimethyl cuprate<sup>11</sup> to give a 1:8:5 mixture (nmr estimate) of the glycol a and the desired alcohol 3<sup>7b</sup>, the latter crystallising from ethanol in about 75% yield.

The oxirane 2<sup>2</sup> gave better results with hexane rather than ether as solvent, and again the desired alcohol 4<sup>6a</sup> crystallised in ~ 70% yield from the syrupy residue upon standing at room temperature<sup>12</sup>.

Compound 3 (or 4) was converted to the xanthate ester<sup>5,13</sup> and the crude product 5 (or 6) was mixed with an equal quantity of biphenyl and pyrolysed in a metal bath<sup>14</sup>. The total pyrolysisate was chromatographed on a silica column eluted with benzene which afforded olefin 7<sup>15</sup> (60% yield from 3) m.p. 141.5-142.5°C [ $\alpha$ ]<sub>D</sub><sup>23</sup> + 106.4 (c = 4.71 in CHCl<sub>3</sub>) or the known isomer 8<sup>16</sup> (50% yield from 4) the only products. However, prolonged pyrolyses caused 1,4-elimination of the elements of methanol from 8 with the formation of the known diene 10<sup>15,16</sup>. However there was never any evidence for the formation of the ketene acetal 9, or indeed of any substances other than 7, 8 or 10 in any of the pyrolyses.

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<sup>8</sup> H. O. House, W. L. Respass and G. M. Whitesides, *J. Org. Chem.*, 31, 3128 (1966).

<sup>9</sup> See for example E. J. Corey and G. H. Posner, *J. Amer. Chem. Soc.*, 89, 3911 (1967),

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<sup>10</sup> R. W. Herr, D. M. Wieland, C. R. Johnson, *ibid.*, 92, 3813 (1970).

<sup>11</sup> To the reagent prepared from 0.08 mole cuprous iodide in ether (90 ml)<sup>8</sup> was added oxirane 1<sup>1</sup> and the reaction allowed to proceed under nitrogen at 0°C for 4 h.

<sup>12</sup> The reaction with 2 is best done on 0.008 mole quantities since with larger (~ 0.04 mole) quantities, the iodohydrin g is formed in appreciable amounts and has to be separated chromatographically.

<sup>13</sup> R. E. Gilman, J. D. Henion, S. Shakshooki, J. I. Patterson, M. J. Bogdanowicz, R. J. Griffith, D. E. Harrington, R. K. Crandall and K. T. Finley, *Can. J. Chem.*, 48, 970 (1970).

<sup>14</sup> For 5 235°C, 1h. For 6 265°C, 0.25 h.

<sup>15</sup> This substance gave satisfactory spectroscopic and analytical data.

<sup>16</sup> B. Fraser-Reid and B. Radatus, *Can. J. Chem.*, 50, 2919 (1972).

<sup>17</sup> B. Fraser-Reid and B. Radatus *Chem. Commun.*, 779 (1970).