Carbohydrate Research, 128 (1984) C9–C10
Elsevier Science Publishers B.V., Amsterdam – Printed in The Netherlands

Preliminary communication

Reductive rearrangement of 3,4,6-tri-*O*-acetyl-D-glucal

GRZEGORZ GRYNKIEWICZ
Physiology–Anatomy Department, University of California, Berkeley, CA 94720 (U.S.A.)
(Received February 18th, 1984; accepted for publication, February 28th, 1984)

Growing interest in chiral cyclic ethers, inspired in part by developments in the polyether antibiotics field[1], calls for efficient, selective methods for their formation, especially in the six-membered-ring series.

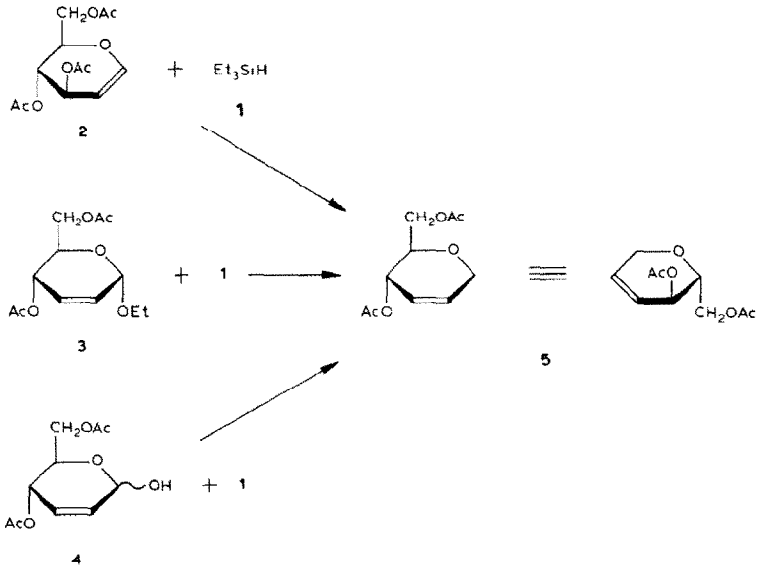
One approach to chiral tetrahydropyrans consists of removal of a substituent at the anomeric center. Among the methods employed for reduction of a hemiacetal function[2], the one based on application of triethylsilane (**1**) as the reducing agent seems particularly interesting, because it eliminates the need for preparation of a glycosyl halide or a 1-thioglycoside intermediate.

The mode of action of **1**, which was shown to reduce lactols[3] and pyranose hemiacetals[4,5], consists of ionic hydrogenation of a carbocation generated in the presence of a Lewis acid[6]. Therefore, it was reasoned that glycals and pseudoglycals, which are known to undergo facile, heterolytic cleavage of the allylic carbon–oxygen bond under the influence of Lewis acids, should be particularly susceptible to this type of hydrogen transfer. To test this hypothesis, 3,4,6-tri-*O*-acetyl-1,5-anhydro-2-deoxy-D-*arabino*-hex-1-enitol (tri-*O*-acetyl-D-glucal, **2**) was chosen, together with two related compounds, namely, ethyl 4,6-di-*O*-acetyl-2,3-dideoxy-α-D-*erythro*-hex-2-enopyranoside (**3**) and 4,6-di-*O*-acetyl-2,3-dideoxy-D-*erythro*-hex-2-enopyranose (**4**).

Pilot experiments on the treatment of **2** with **1**, under a variety of conditions, proved inconclusive owing to coincident R_F values of **2** and its reduction product in several t.l.c. solvent-systems tried. On the other hand, t.l.c. monitoring (on plates of silica gel with 1:1 hexane–ethyl acetate) of the reaction of **3** with a slight excess (1.2 mol. equiv.) of **1**, conducted in dichloromethane solution at room temperature in the presence of an equivalent amount of boron trifluoride etherate, indicated quick and complete conversion of the substrate **3** into a single product. Processing of the reaction mixture by washing with aqueous sodium carbonate, drying, and evaporating the solvent, followed by Kugelrohr distillation at 140° and 20 Pa, afforded pure **5** as a colorless oil in 95% yield; $[\alpha]_D^{20}$ +85.0° (*c* 1.0, CH_2Cl_2); 90-MHz, ^{1}H-n.m.r. (in CCl_4 as the solvent, with Me_4Si as the internal standard; Varian EM-390): δ 2.02 (s, 6 H, 2 AcO), 3.58 (m, 1 H, H-5), 4.09 (m, 4 H, H-1,6,1′,6′), 5.12 (bd, 1 H, $J_{4,5}$ ~9.0 Hz, H-4), 5.78 (2 ABq, 2 H, $J_{2,3}$ ~12.0, J ~2.5, ~3.0 Hz, H-2,3). Analogous treatment of **2** afforded the same product, yields of 95–97% of purified compound **5** being consistently obtained from **2** in 1–10-mmol-scale preparations. Reaction of

0008-6215/84/$03.00 © 1984 Elsevier Science Publishers B.V.

hexenose **4** with **1** also resulted in formation of **5**, but, in this case, the product required chromatographic purification, and was isolated in 79% yield.



In view of the bidentate character[7,8] of the intermediate carbocation generated from **2** or **3**, and the known reduction of alkyl hex-2-enopyranosides (*e.g.*, **3**) to glycals with lithium aluminum hydride[9], a search was conducted for some evidence of hydrogenation taking place at C-3 of the pyranoid ring. However, examination, by ^{1}H-n.m.r. spectroscopy, of the crude reaction-mixtures obtained by the action of **1** on **2**, **3**, or **4** did not reveal the presence of any 1,2-unsaturated product. Apparent regiospecificity of the reductive rearrangement of **2** and the reductive removal of the anomeric substituent in **3** and **4** is in keeping with the HSAB interpretation of Lewis acid-catalyzed, nucleophilic substitution–rearrangement of glycals[7,8]. It may be pointed out that 4,6-di-*O*-acetyl-1,5-anhydro-2,3-dideoxy-D-*erythro*-hex-2-enitol (**5**) may be envisaged as a precursor of both α-D- and β-L-*C*-glycosyl compounds of the pentopyranosyl series.

REFERENCES

1 J. W. Westley (Ed.), *Polyether Antibiotics: Naturally Occurring Acid Ionophores*, Vol. 2, Dekker, New York, 1983.
2 P. Kocienski and C. Pat, *Carbohydr. Res.*, 110 (1982) 330–332, and references cited therein.
3 G. A. Kraus, K. A. Frazier, B. D. Roth, M. J. Taschner, and K. Neuenschwander, *J. Org. Chem.*, 46 (1981) 2417–2419.
4 M. D. Lewis, J. K. Cha, and Y. Kishi, *J. Am. Chem. Soc.*, 104 (1982) 4976–4978.
5 D. Rouzand and P. Sinaÿ, *J. Chem. Soc., Chem. Commun.*, (1983) 1353–1354.
6 D. N. Kursanov, Z. N. Parnes, and N. M. Loim, *Synthesis*, (1974) 633–651.
7 W. Priebe and A. Zamojski, *Tetrahedron*, 36 (1980) 287–297.
8 R. D. Guthrie and R. W. Irvine, *Carbohydr. Res.*, 82 (1980) 207–224.
9 B. Fraser-Reid, *Acc. Chem. Res.*, 8 (1975) 192–201.