Novel Epimerizations of Ring-fused Cyclopropanecarbaldehydes Catalysed by Iodide Salts

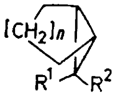
By David L. Garin

(*Department of Chemistry, University of Missouri-St. Louis, St. Louis, Missouri* 63121)

Summary Ring-fused cyclopropanecarbaldehydes can be epimerized under mild conditions by use of specific iodide salts as catalysts; these reactions can occur through the intermediate cleavage of the cyclopropane ring.

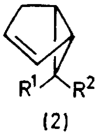
In the course of another investigation, we noted the unexpected lithium iodide-catalysed epimerization of two ring-fused cyclopropanecarbaldehydes (1a; $n = 1$ or 2) to the thermodynamically more stable *exo*-isomers (1b) under extremely mild conditions.[1]

In the initial belief that the epimerizations were proceeding *via* enol intermediates, we attempted to utilize the reaction as a method of α-alkylation and deuteriation of cyclopropanecarbaldehydes. For the latter, we employed pyridinium iodide in dimethyl sulphoxide, which rapidly epimerizes bicyclo[3,1,0]hex-2-ene-6-*endo*-carbaldehyde (2a)[2] to the corresponding *exo*-isomer (2b) (15 min at room temperature).† Following the reaction by n.m.r. and using deuteriated pyridinium iodide in $(CD_3)_2SO–D_2O$ (3 : 1), we observed the formation of (2b) without the incorporation of deuterium as determined by proton integration of the n.m.r. spectrum. These results and others suggested a non-enolic pathway, which we tested by utilizing the α-methylcyclopropanecarbaldehyde (2c). Treatment of the chloro-alcohol (3) with base gives (2c) as the major component of a mixture.[4] Addition of LiI–$CDCl_3$ or pyridinium iodide–$(CD_3)_2SO$ to crude (2c) results in epimerization to (2d) as evidenced in the n.m.r. spectrum by the appearance of the aldehydic proton signal of (2d) at slightly higher field [$\tau(CDCl_3)$ 0·9 (s)] than that of (2c) [τ ($CDCl_3$) 0·7 (s)]. Initially, the increase in the upfield aldehydic signal corresponds to the decrease in the downfield signal but after *ca.* 50% transformation both signals decrease owing to further



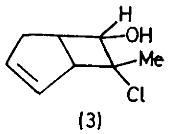
(1)

	R^1	R^2
a;	CHO	H
b;	H	CHO
c;	CO_2Me	H

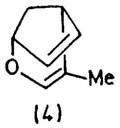


(2)

	R^1	R^2
a;	CHO	H
b;	H	CHO
c;	CHO	Me
d;	Me	CHO
e;	Me	CO_2H
f;	CO_2H	Me
g;	H	CO_2H
h;	CO_2Me	H



(3)



(4)

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† This transformation can also be catalysed by lithium iodide–chloroform or tetracarbonyl-μ-dichloro-dirhodium.[3]

reactions. When the aldehydic signal of (2c) had disappeared, the reaction mixture was filtered and oxidized with silver oxide to give the known 6-*exo*-carboxylic acid (2e).[5] The structures of (2c) and (2b) were verified by similar oxidation to the known acids (2f)[5] and (2g),[6] respectively.

Thus, the intermediacy of an enol is not required; the epimerization of (2c) must occur through the intermediate cleavage of the cyclopropane ring, possibly by altering the equilibrium pathway (2c) $\rightleftharpoons$ (4).[4] The choice of the catalyst is critical; pyridinium iodide does not epimerize (1a) and other lithium salts are not effective (*e.g.* lithium thiocyanate and lithium acetate). Epimerization does not occur with the related esters (1c; $n = 1$) and (2h) under these conditions.

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[1] D. L. Garin, *J. Org. Chem.*, **1971**, **36**, **1697**.

[2] J. Meinwald, S. S. Labana, and M. S. Chadha, *J. Amer. Chem. Soc.*, 1963, **85**, 582.

[3] R. Grigg and G. Shelton, *Chem. Comm.*, 1971, 1247.

[4] P. R. Brook and A. J. Duke, *Chem. Comm.*, 1970, 652.

[5] D. L. Garin and K. L. Cammack, *J.C.S. Chem. Comm.*, 1972, 333.

[6] J. Warkentin, E. Singleton, and J. F. Edgar, *Canad. J. Chem.*, 1965, **43**, 3456.