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A NOVEL SYNTHESIS OF 2-LITHIO DERIVATIVES OF 2-SUBSTITUTED-1,3-DITHIANES. THE ADDITION OF ORGANOLITHIUM REAGENTS TO TRIMETHYLENEDITHIOCARBENE AND TO 2-METHYLENE-1,3-DITHIANE

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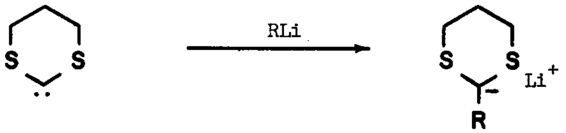
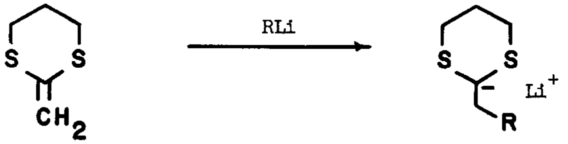
The dithiane synthesis of carbonyl compounds, as developed by Corey and coworkers[2], involves the conversion of the potential carbonyl carbon into a reactive 2-lithio-1,3-dithiane. We have found that 2-lithio derivatives of 2-substituted dithianes can be efficiently generated by the addition of organolithium compounds to trimethylenedithiocarbene (I) and to 2-methylene-1,3-dithiane (III). These additions represent methods for the extension of selected organolithium reagents by 1 and 2 carbon atoms respectively (Eqns. 1 & 2).



I II

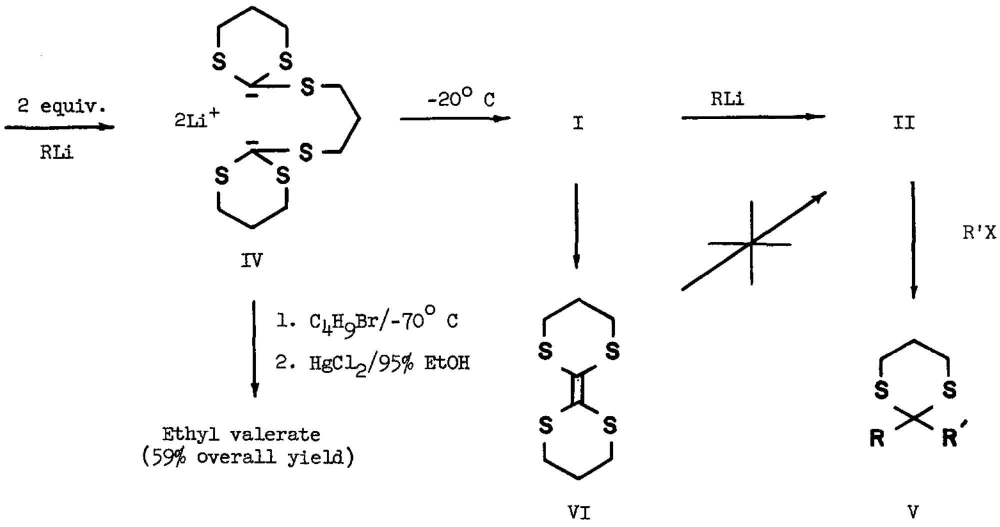
(R + 1C) Eqn. 1



III IV

(R + 2C) Eqn. 2

Seebach has recently presented evidence for a carbene intermediate in the formation of tetraalkylthioethylene derivatives from metalated orthothioformates[3]. We have been able to trap the proposed carbene (I) as the stable 2-lithio derivatives of 2-substituted-1,3-dithianes by allowing a tetrahydrofuran solution of the metalated orthothioformate (IV) to decompose (-20° C) in the presence of an equivalent amount of an organolithium compound (RLi, R = C_6H_5, n-C_4H_9, t-C_4H_9).



Support for the presence of the reactive carbene (I) at -20° is found in the ability to detect the metalated orthothioformate (IV) at -70° by alkylation with butyl bromide and subsequent conversion to ethyl valerate and the recovery of VI when it was reacted with n-butyl lithium under the conditions for the formation of 2-lithio-2-n-butyl-1,3-dithiane (II, R = n-C_4H_9).

CHART 1

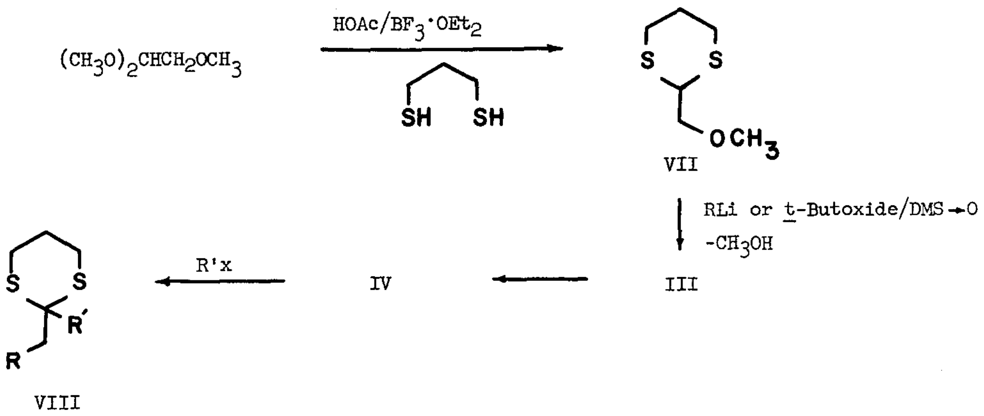
2-Substituted 1,3-dithianes (V)[a]		B.p. (m.p.)	Yield %
R	R'		
C_6H_5-	H	(70-71)[b]	67
n-C_4H_9	H	94/0.7 mm	57
t-C_4H_9	H	113/15 mm	71
n-C_4H_9	$C_6H_5CH_2$-	210-15°[c]/0.5 mm	82

[a] All new compounds have the proper elemental analysis.

[b] Lit.[4] m.p. 70-71°.

[c] Bath temperature.

2-Methylene-1,3-dithiane (III), prepared by the elimination of methanol from 2-methoxymethyl-1,3-dithiane (VII), also undergoes the addition of alkyl lithiums in excellent yields. The direction of addition is such as to provide exclusively the 2-lithio-2-alkyl-1,3-dithiane.



The anions that can be generated by these techniques are subject to all the useful reactions characteristic of the original dithiane synthesis. For example, the alkylation of II (R = n-C_4H_9) with benzyl bromide gives 2-n-butyl-2-benzyl-1,3-dithiane (V, R = n-C_4H_9, R' = benzyl) and the alkylation of IV (R = n-C_4H_9) with n-pentyl iodide gives 2,2-di-n-pentyl-1,3-dithiane (VIII, R = n-C_4H_9, R' = n-C_5H_{11}).

CHART 2

Compound[a]	B.p. (m.p.)[b]	Yield %
2-methoxymethyl-1,3-dithiane (VII)	122-124/14 mm	65
2-methylene-1,3-dithiane[c] (III)	86-88/12 mm	73[d]
2-n-pentyl-1,3-dithiane (VIII, R' = H, R = n-C_4H_9)	94/0.7 mm	91[d]
2-(2-methylbutyl)-1,3-dithiane (VIII, R' = H, R = s-C_4H_9)	135/12 mm	94[d]
2-neopentyl-1,3-dithiane (VIII, R' = H, R = t-C_4H_9)	120-1/4 mm	98[d]
2,2-di-n-pentyl-1,3-dithiane (VIII, R' = n-C_5H_{11}, R = n-C_4H_9)	100/0.05 mm	79[e]

[a] All new compounds have the proper elemental analysis.

[b] Analytical sample.

[c] Sample subject to rapid decomposition at room temperature.

[d] Vpc analysis.

[e] Contains 14% 2-n-pentyl-1,3-dithiane as determined by vpc analysis.

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