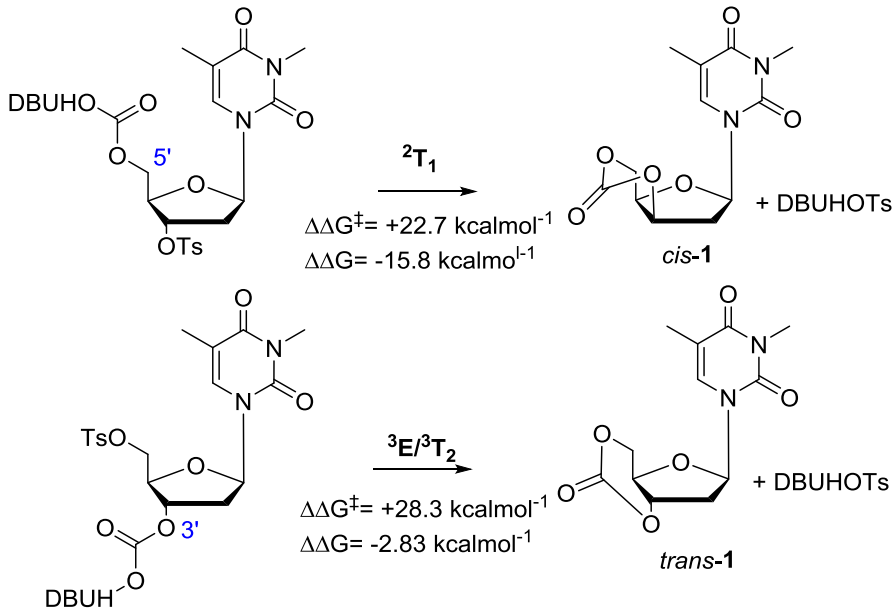
Ring-closing Cyclisation

Intramolecular "S_N2-type" Mechanism

DFT calculations at the same level of theory support experimentally findings for the formation of a 3',5'-*cis*- cyclic carbonate by backside attack of the carbonate nucleophile at the 5'-position, displacing the tosyl leaving group and inverting the stereochemistry at the 3'-position. Although, synthetically less challenging, the reverse process, attack of the carbonate at the 3'-position to displace a tosyl leaving group at the 5'-position, leading to formation of the 3',5'-trans-cyclic carbonate, poses a higher kinetic barrier and lower thermodynamic driving force. At this level of theory, the isolated *cis*-cyclic carbonate **1** (reported here) is 9.2 kcal mol^{-1} lower in energy compared to theoretical unreported *trans*-cyclic carbonate.



Scheme S1. Kinetic and thermodynamic parameters for ring-closing by an intramolecular displacement reaction calculated at the rωb97xd/6-31+G(d)/cpcm=acetonitrile/298 K level of theory. $^2T_1$ refers to the 2'-endo-1'-exo twist conformation of the furanose ring in the lowest energy transition state located. The input for *cis*-**1** was taken from the X-ray crystal structure data.

	Structure	***G /Hartrees***	***ΔG/ kcalmol^{-1}***
	Trans_1	-1026.099913	
	Cis_1	-1026.11592	
	DBUHOTs	-1356.918481	
Intramolecular S_N2 ring-closing with 5'-carbonate nucleophile	5carbonate3tosyl	-2383.009237	0.0
	5carbonate3tosyl_TS	-2382.97299	+22.7
	Cis_1 + DBUHOTs	-2383.034401	-15.8
Intramolecular S_N2 ring-closing with 3'-carbonate nucleophile	5tosyl3carbonate	-2383.013888	0.0
	5tosyl3carbonate_TS	-2382.968715	+28.3
	trans_1 + DBUHOTs	-2383.018394	-2.83

Table S1. Computed Gibbs Free Energies at the rωB97XD/6-31+g(d)/cpcm=acetonitrile/298K level of theory for the formation of *trans*-**1** (hypothetical) and *cis*-**1** (reported here) by intramolecular S_N2-like ring-closing with 3'- or 5'-carbonate nucleophile.

Full coordinates for all the stationary points, together with computed free Gibbs energy and vibrational frequency data, are available via the corresponding Gaussian 09 output files, stored in the digital repository: DOI: 10.6084/m9.figshare.4309616 (private link for review purposes: https://figshare.com/s/8c40dbc3dd5424f22680).