It was satisfying to see that, in the uvaricin and asimicin cases (i.e., **3** and **7**), the entries with the lowest $\Sigma|\Delta\delta\text{'s}|$ values (16 and 9) corresponded to the stereochemistries (i.e., er/t/th/t/th and th/t/th/t/th) that had been assigned by simple inspection (vide supra). Even more rewarding was the fact that, for the case of rolliniastatin 1 triacetate (**5**), the entry with the lowest $\Sigma|\Delta\delta\text{'s}|$ value (13) corresponded to the stereochemistry (er/c/th/c/th) known[6] for rolliniastatin 1 (**4**). It is clear from the relative magnitudes of the sums of the $|\Delta\delta\text{'s}|$ that the more quantitative analysis developed and described here was necessary to reach a conclusive decision regarding the "best match" for rolliniastatin 1 triacetate (**5**). The fact that the stereochemistry so identified is identical with that known for rolliniastatin 1 lends considerable validity to this type of approach to structure determination. It is likely that other opportunities to apply this method to new members of this group of bis(tetrahydrofuranyl) acetogenins will present themselves. We predict that, more often than not, this method will be the only way to access this stereochemical knowledge.

Acknowledgment. This investigation was supported by Grant GM-34492 awarded by the DHHS and by an award from the Alfred P. Sloan Foundation.

Registry No. **2a**, 109215-01-2; **2b**, 109215-02-3; **2c**, 109215-03-4; **2d**, 109215-04-5; **2e**, 109215-05-6; **2f**, 109215-06-7; **2g**, 109215-07-8; **2h**, 109215-08-9; **2i**, 109215-09-0; **2j**, 109215-10-3; **2k**, 109215-11-4; **2l**, 109215-12-5; **3**, 109122-75-0; **4**, 111056-97-4; **5**, 116865-22-6; **6**, 102989-24-2; **7**, 116947-15-0.

Thomas R. Hoye,*[1] Zhi-ping Zhuang
Department of Chemistry
University of Minnesota
Minneapolis, Minnesota 55455-0431

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Table I. Nuclear Overhauser Effect (NOE) Data at Room Temperature

	enhancement (%)[a]		
	1′,3(eq)[b]	1′,4	3(eq),1′
1a	6.9	7.2	8.7
2a	5.1	0.0	6.1
3a	5.2	3.1	9.1
1b	4.6	5.3[c]	8.0
2b	3.2	0.0	5.1
3b	5.1	5.1	6.3

	enhancement (%)[a]					
	1′,5(eq)	1′,4	5(eq),1′	4,1′	4,2′	2′,4
4a	4.8	12.1[d]	11.7[e]	*f*	*f*	3.4[d]
5a	5.1	4.3	4.8	1.9	1.6	*f*
6a	5.7	5.9	5.9	3.4	3.8	4.8
4b	NOE[g]	5.2	*f*	5.3	*f*	*f*
5b	*f*	*f*	4.6[h]	4.2[h]	*f*	*f*
6b	*f*	*f*	2.9[h]	2.3[h]	*f*	*f*

	enhancement (%)[a]		
	1′,3	1′,4	4,1′
7a	4.0	3.5	4.8
8a	1.7	3.2	5.5
7b	5.7	2.9	3.1
8b	1.2	2.5	2.7

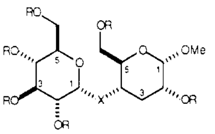
[a] NOE experiments were performed in CD_3OD for **1a**, **2a**, **3a**, **4a**, **5a**, and **6a**, in $CDCl_3$ for **1b**, **2b**, **3b**, and **4b**, in C_6D_6 for **5b**, **6b**, **7b**, and **8b**, and in D_2O containing 13% pyridine-d_5 for **7a** and **8a**. [b] This notation indicates that an NOE enhancement of H-3(eq) was observed on irradiation of H-1′. [c] H-4, H-5(5′), and H-3′ overlap. NOE enhancement of H-5(5′) and H-3′ could not be excluded. [d] H-3, H-4, and H-6′ overlap. NOE enhancement of H-3 and H-6′ could not be excluded. [e] Partial irradiation of H-4 may contribute to the magnitude of the observed NOE. [f] This data is not available. [g] H-5(eq), H-3′, H-4′, H-6a′, and H-6b′ overlap. A 5.4% enhancement within this multiplet was observed and was assigned to H-3′ and H-5(eq). NOE enhancement of H-4′, H-6a′, and H-6b′ could not be excluded. [h] H-1′, H-2′, H-5′, and H-OMe overlap. NOE enhancement of H-2′, H-5′, and H-OMe could not be excluded.

Preferred Conformation of *C*-Glycosides. 5. Experimental Support for the Conformational Similarity between *C*- and *O*-Disaccharides

Summary: Experiments demonstrating the conformational similarity between the *C*-disaccharides **2**, **5**, and **8** and the corresponding parent *O*-disaccharides **1**, **4**, and **7** are reported.

Sir: We have recently developed and provided experimental support for a model to predict the preferred conformations of *C*-glycosides, based on the analysis of steric interactions primarily around the nonglycosidic bond.[1] In the interest of extending its predictive value to the corresponding parent glycosides, we have undertaken studies to compare the conformational preferences of representative *C*- and *O*-disaccharides. In this paper we present the results of our investigations.

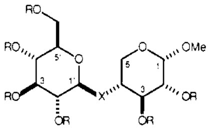
The methyl *C*-disaccharides **2**, **5**, and **8**[1e] and the corresponding oxygen-linked systems **1**, **4**, and **7**[2] were chosen for study. On the basis of our model, each of these compounds is expected to exist predominantly in one conformation in the ground state. In order to compare the two series, recourse was made to nuclear Overhauser effects (NOE) and T_1 measurements. These techniques have been used extensively in the conformational analysis of oligosaccharides.[3] However, we must emphasize that we are not attempting to use these methods as the principal means of conformational analysis. Experimentally, we *first* establish the conformational preference of the carbon series, relying on the values of vicinal spin–spin coupling constants, and *second* compare the conformational behavior of *O*- and *C*-disaccharides through NOE and T_1 data.



1a: X=O, R=H
1b: X=O, R=Bn

2a: X=CH$_2$, R=H
2b: X=CH$_2$, R=Bn

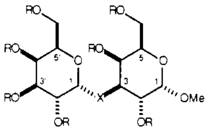
3a: X=CD$_2$, R=H
3b: X=CD$_2$, R=Bn



4a: X=O, R=H
4b: X=O, R=Bn

5a: X=CH$_2$, R=H
5b: X=CH$_2$, R=Bn

6a: X=CD$_2$, R=H
6b: X=CD$_2$, R=Bn



7a: X=O, R=H
7b: X=O, R=Bn

8a: X=CH$_2$, R=H
8b: X=CH$_2$, R=Bn

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(2) These were prepared by known literature methods; see: Schmidt, R. R. *Angew. Chem., Int. Ed. Engl.* **1986**, *25*, 212. Schemes for the syntheses of **1a**,**b**, **4a**,**b**, and **7a**,**b** are included in the supplementary material. All the new compounds reported in this paper gave satisfactory spectroscopic data, including ^{1}H NMR, IR, and MS.

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Table II. Proton Spin-Lattice Relaxation Time (T_1, s) at Room Temperature[a,b]

	H-1'	H-3(eq)	H-4
1a	0.94	0.36	0.79
2a	0.72	0.36	0.36[c]
3a	0.71	0.37	0.81
1b	0.65	0.29	*d*
2b	0.50	0.25	0.50
3b	0.65	0.29	0.65
	H-1'	H-4	H-5(eq)
4a	0.79	0.79	0.50
5a	0.58	0.58	0.36
6a	0.87	1.01	0.43
4b	0.58	0.72	*e*
5b	0.65	0.58	0.36
6b	0.89	1.0	0.38
	H-1'	H-3	H-4
7a	0.79	0.79	0.69
8a	0.58	0.50	0.54
7b	0.69	0.65	0.54
8b	0.43	0.58	0.45

[a] T_1 measurements were performed in CD_3OD for **1a**, **2a**, **3a**, **4a**, **5a**, and **6a**, in $CDCl_3$ for **1b**, **2b**, **3b**, and **4b**, in C_6D_6 for **5b**, **6b**, **7b**, and **8b**, and in D_2O containing 13% pyridine-d_5 for **7a** and **8a**. [b] T_1 values were obtained from a plot for all the compounds except **3a** and **6b**, for which a curve-fitting method was employed. [c] H-4 and H-α overlap. The T_1 value for H-4 might not be exact but is not larger than 0.36. [d] H-4, H-3', and H-5(5') overlap. The T_1 value for H-4 could not be determined. [e] H-5(eq), H-3', H-4', H-6a', and H-6b' overlap. The T_1 value for H-5(eq) could not be determined.

Diamond lattice analysis[1d,e] of compounds **1a,b** and **2a,b** suggests that the preferred conformation for each should be A depicted in Figure 1. The vicinal spin–spin coupling constants in the carbon series firmly support this prediction.[1e] In this conformation, H-1' and H-3(eq) are in close enough proximity that NOE enhancements should be observable. In accord with this expectation, irradiation of H-1' in compounds **1a** and **1b** gave rise to 6.9% and 4.6% enhancements of H-3(eq), respectively (Table I). The corresponding experiments with compounds **2a** and **2b** gave 5.1% and 3.2% enhancements of H-3(eq), respectively. In neither case did H-3(ax) show any detectable NOE enhancement, as expected from the predicted conformation. The NOE experiments in the opposite direction were also consistent with this conformational assignment.

On irradiation of H-1', a distinct NOE was observed on H-4 of compounds **1a** and **1b**, whereas no NOE was detected on H-4 of the corresponding *C*-disaccharides **2a** and **2b**. Since the CH_2 bridge in **2a** and **2b** was the likely source of this discrepancy, the dideuterio analogues **3a** and **3b** were prepared.[1e] Indeed, the relaxation time for H-4 of **3a** and **3b** was much longer than that in **2a** and **2b** (Table II), reflecting the decrease of spin–spin interactions between H-4 and the CD_2 bridge. Irradiation of H-1' produced 3.1% and 5.1% enhancements of H-4 in **3a** and **3b**, respectively. Thus, the absence of an NOE between H-1' and H-4 in compounds **2a** and **2b** is primarily due to the spin–spin interactions of H-4 with the CH_2 bridge protons rather than to conformational dissimilarity between *O*- and *C*-disaccharides.

The observation of an NOE between H-1' and H-4 in compounds **1a,b** and **2a,b** was not expected for the ideal conformation A depicted in Figure 1. Consideration of this result in conjunction with the appropriate vicinal spin–spin coupling constants for compounds **2a** and **2b**[1e] brings to light at least two plausible explanations: the preferred conformation of these may deviate slightly from the ideal gauche arrangement around the nonglycosidic bond or a small amount of another conformer may be present in the

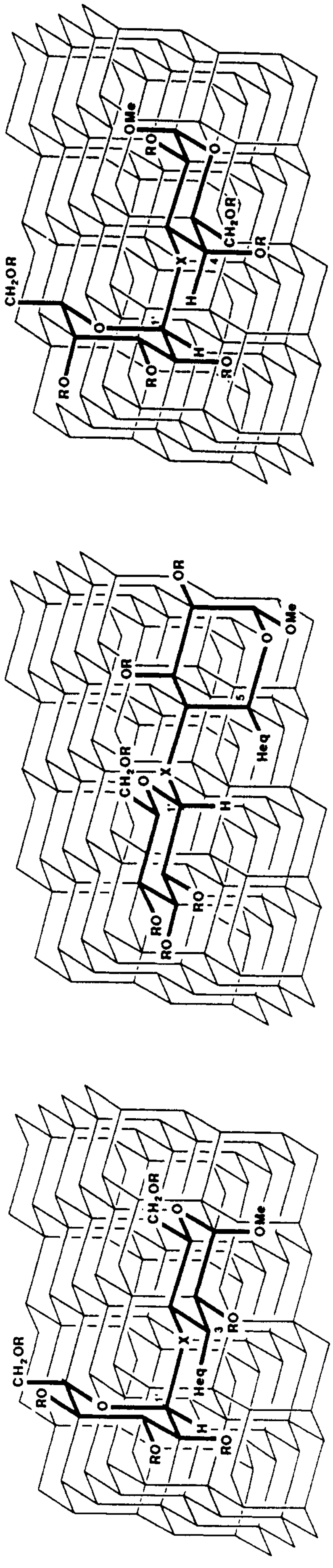

Figure 1. Preferred conformation of *C*- and *O*-disaccharides predicted by diamond lattice analysis.

solution. Further study is necessary to clarify the exact nature of this effect.

Analogous NOE and T_1 studies indicate that disaccharides **4** and **5** (**6**) exist in essentially the same preferred conformation, i.e., B in Figure 1, as do **7** and **8**, i.e., C in Figure 1.[4] Furthermore, the experimentally determined preferred conformation in each of these systems[1e] is close to the one predicted by diamond lattice analysis.

In summary, we have shown that *C*-disaccharides **2a**,**b**, **5a**,**b**, and **8a**,**b** and the corresponding parent disaccharides **1a**,**b**, **4a**,**b**, and **7a**,**b** are conformationally similar. In addition, we have demonstrated that analysis of steric interactions primarily around the nonglycosidic bond in the *C*- and *O*-disaccharides, using a diamond lattice, provides a useful model for predicting the preferred conformation in these systems. In all the cases examined, the experimentally determined preferred conformation was found to correspond well, at least to the first approximation, with the predicted conformation.

Acknowledgment. We are deeply indebted to Professor Singel and Dr. Huang of Harvard University for helpful discussions on NMR studies. Financial support from the National Institutes of Health (NS 12108) is gratefully acknowledged. W.H.M. thanks the National Institutes of Health for the support of a Postdoctoral Fellowship (1 F32 GM 11547).

Supplementary Material Available: Schemes for the synthesis of **1a**,**b**, **4a**,**b**, and **7a**,**b** (3 pages). Ordering information is given on any current masthead page.

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[4] The dideuteriated analogues of **8a**,**b** are not available at this time. However, based on the other two cases reported here, we anticipate that the dideuterated substrates of **8a**,**b** will yield data which compares even better with that observed for **6a**,**b**.

William H. Miller, David M. Ryckman
Peter G. Goekjian, Yuan Wang, Yoshito Kishi*
Department of Chemistry
Harvard University
12 Oxford Street
Cambridge, Massachusetts 02138

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Regioselective Silylolefination of Allylic Dithioacetals. Stereoselective Synthesis of 1-(Trimethylsilyl)butadienes[1]

Summary: 1-(Trimethylsilyl)butadienes are regioselectively and stereoselectively synthesized in good to excellent yields from the reactions of allylic dithioacetals and [(trimethylsilyl)methyl]magnesium chloride in the presence of 5 mol % of $NiCl_2(PPh_3)_2$ in refluxing ether–benzene. Alkyl or aryl substituents at C-2 and/or C-3 positions in the starting dithioacetals do not affect the regiochemistry of the reactions. The regioselectivity of this reaction may arise from the interaction of the sulfur moiety in dithioacetals with nickel during the course of the reaction.

Sir: 1-(Trimethylsilyl)butadienes (**1**) are apparently valuable building blocks in organic syntheses but have only briefly been explored.[2-5] Most of literature methods for the preparation of **1** require multistep synthesis, and sometimes starting materials are not readily accessible.[2-5] The transition metal catalyzed coupling reaction of organosulfur compounds with Grignard reagents is well-documented.[6] We recently reported that benzylic dithioacetals can couple with Grignard reagents to give alkylated olefins.[7] (*E*)-β-silylstyrenes were conveniently prepared according to this procedure.[7b] Allylic dithioacetals (**2**) have two possible sites for coupling, and it is noted that reactions with allylic acetals[8] and geminal diacetates[9] are generally nonselective. However, the sulfur moiety in **2** might have directive effect to stabilize the intermediate such that the regiochemistry of the coupling reaction could be controlled. We have tested this viewpoint and now describe the nickel-catalyzed coupling reaction of **2** with Me_3SiCH_2MgCl (**3**).

In a typical procedure a mixture of **2**[10] and 4 equiv of **3** in the presence of 5 mol % of $NiCl_2(PPh_3)_2$ in ether–benzene was heated under reflux overnight. After usual workup and chromatographic purification, the silylated dienes **1a–j** were obtained in good to excellent yields.[11] The results are tabulated in Table I.

As can be seen from Table I, the reaction provides a very efficient synthesis of **1** and, more importantly, the reaction is regiospecific. Alkyl or aryl substituents at C-2 and C-3 positions in **2** do not affect the selectivity. The nature of the dithioacetal functionality has essentially no effect on the reaction. Either open chain (entry 10) or six-membered ring (entry 11) dithioacetals afforded **1a** in 82 and 76% yields, respectively. It is interesting to note that conjugative preference[12] is not essential in these reactions, e.g., crotonaldehyde derivative giving **1f** in 65% yield (entry 6). A similar observation was made in the reaction of **2g** (entry 7).

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