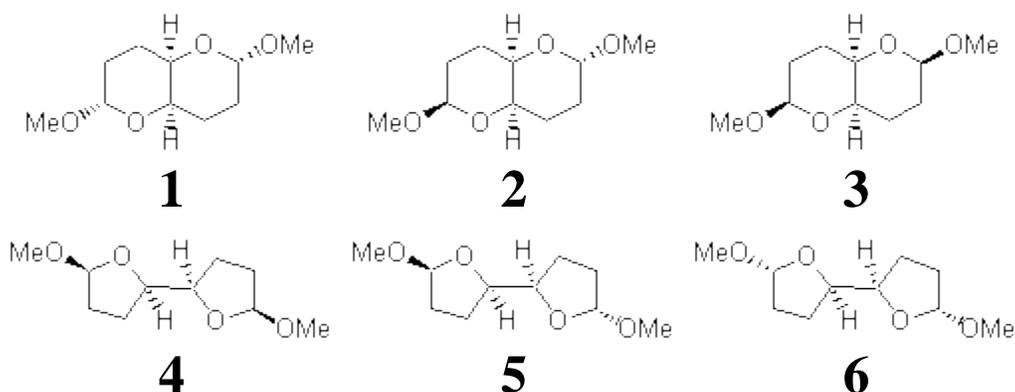


PREDICTING THE ^{13}C NMR OF ELATENYNE

At the Spring ACS meeting in New Orleans this past April, Jonathan Goodman told me about his group's new work on computed NMR spectra. This study has now appeared.¹ The new aspect of this work is taking on compounds with significant conformational flexibility. They first examined the bifuranyl- and pyranopyrans acetals **1-6**.

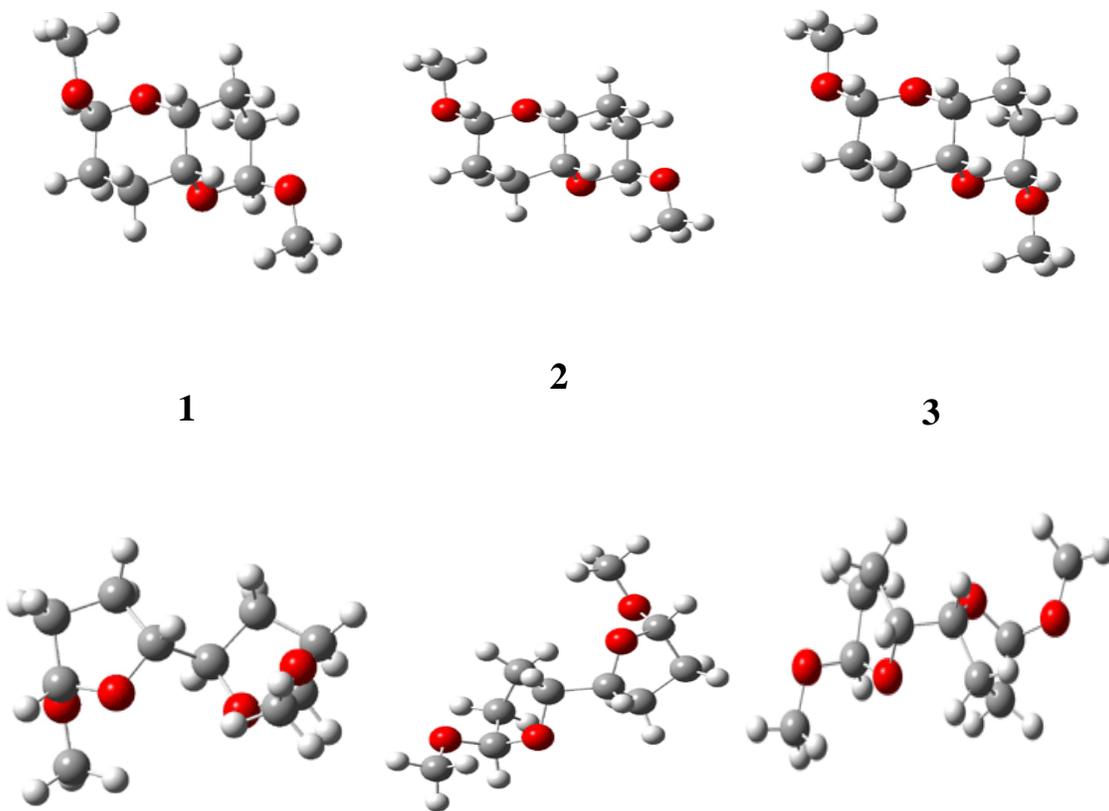


They identified all energetically low-lying conformers through a Monte Carlo MM search, and reoptimized the structures at B3LYP/6-31G**. PCM energies, with the dielectric set to 4.81 to simulate CHCl_3 , were obtained using the gas-phase geometries. ^{13}C NMR shifts were then computed and weighted based on Boltzmann averaging.

Compounds **4-7** require consideration of 4, 5, or 7 conformations, respectively, to account for at least 95% of the population. (The lowest energy conformation for each compound is displayed in Figure 1.)

The computed ^{13}C NMR chemical shifts were then compared against the experimental values that have been obtained for 5 of these 6 compounds, though it was not known which experimental spectra corresponds with which structure.

Based on the correlation coefficients and the mean and maximum values of the differences between the calculated and experimental shifts allows for identification of the structure that corresponds to each of the five spectra.



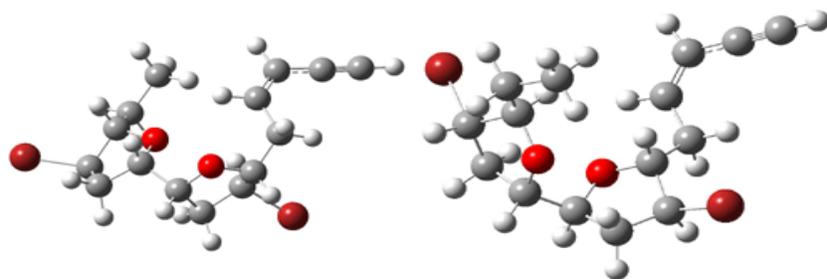
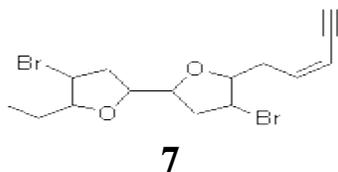
4

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6

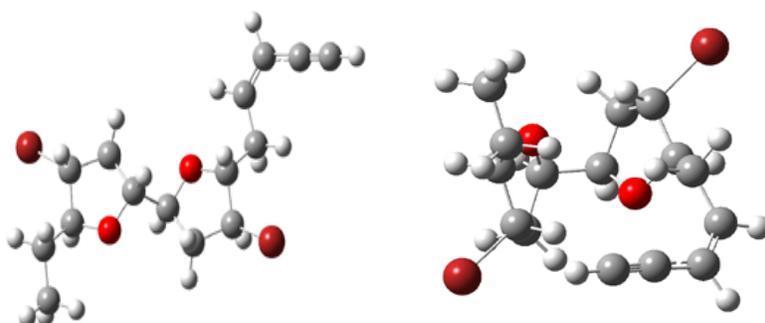
Figure 1. B3LYP/6-31G** minimum energy conformation of **1-6**.¹

They next took on the absolute structure of elatenyne **7**. This compound has been isolated and its ¹³C NMR obtained and interpreted.² The compound can exist in one of 32 different diastereomers. Instead of having to stereospecifically synthesize each diastereomer, obtain its NMR spectra and compare with the natural product, Goodman suggests that one can compute the ¹³C NMR spectra for each isomer, identified the likely candidates, and synthesize just those if verification is necessary. So, they computed the spectra of all 32 isomers following the above prescription. The chemical shifts for the carbons bearing bromine have relatively large errors, though these can be systematically corrected by reducing the computed values by about 20 ppm. Comparison of the computed spectra of each isomer with the experimental spectra gave three possible isomers (**7a-c**, see Figure 2) with very strong correlation coefficients. Examination of the mean value of the difference of the computed chemical shifts with the experimental values (not including the carbon atoms with a bromine attached) suggests one more possibility **7d** (see Figure 2).



7a

7b



7c

7d

Figure 2. B3LYP/6-31G** minimum energy conformation of **7a-d**.¹

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