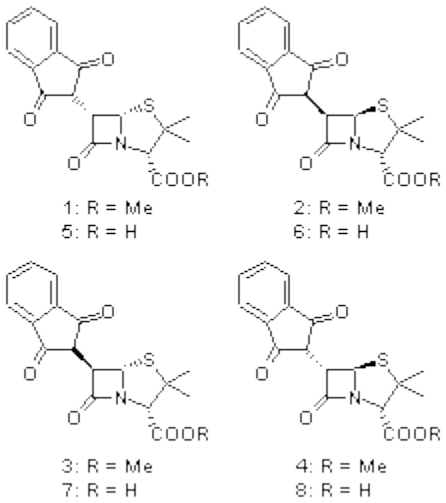
PREDICTING NMR CHEMICAL SHIFTS OF PENAM B-LACTAMS

Cramer and Hoye have applied DFT computations to the predictions of both protons and carbon NMR chemical shifts in penam β-lactams[1] using the procedure previously described in my blog post Predicting NMR chemical shifts. They examined the compounds 1-8 by optimizing low energy conformers at B3LYP/6-31G(d) with IEFPCM (solvent=chloroform). The chemical shifts were then computed using these geometries with the larger 6-311+G(2d,p) basis set and four different functionals: B3LYP, PBE1 and the two specific functionals designed to produce proton and carbon chemical shifts: WP04 and WC04.



A number of interesting results are reported. First, all three functionals do a fine job in predicting the proton chemical shifts of **1-8**, with WP04 slightly better than the other two.On the other hand, all three methods fail to predict the carbon chemical shifts of **1-3**, though B3LYP and PBE1 do correctly identify **5-8**. The failure of WC04 is surprising, especially since dimethyl disulfide was used in the training set. They also noted that WP04 using just the minimum energy conformation (as opposed to a Boltzmann averaged chemical shift sampled from many low energy conformers) did correctly identify lactams **1-4**. This is helped by the fact that the lowest energy conformer constituted anywhere form 37% to 68% of the energy-weighted population.

Source: http://comporgchem.com/blog/?p=41