PROTOCOL FOR COMPUTING NMR CHEMICAL SHIFTS

I have posted on the use of computed NMR chemical shifts and coupling constants to help aid in structure identification. The second edition of my book *Computational Organic Chemistry* has a largely all-new chapter on structure identification aided by computed spectra, especially NMR spectra. In my recent opinion piece speculating on challenges in computational organic chemistry,[1] the first area I highlight is encouraging the larger use of computed spectra as an essential component of structure determination.

While more and more non-traditional computational users are employing quantum computations towards these problems, I suspect that many non-users are a bit wary about stepping into an arena they are not expert in, an arena chock-filled with acronyms and methods and potentially little guidance. While some very nice papers[2-6] and web sites (Chemical Shift Repository (Cheshire) andDP4) do outline procedures for using computations in this fashion, they are not truly designed for the non-specialist.

Well, fear not any longer. Hoye and coworkers, synthetic chemists who have utilized computational approaches in structure determinations for a number of years, have written a detailed step-by-step protocol for using a standard computational approach towards structure determination.[7] The article is written with the synthetic chemist in mind, and includes a number of scripts to automate many of the steps.

For the specialist, the overall outline of the protocol is fairly routine:

1. Utilize MacroModel to perform a conformational search for each proposed structure, retaining the geometries within 5 kcal mol^{-1} of the global minimum.
2. Optimize these conformations for each structure at M06-2x/6-31+G(d).
3. For each conformation of each structure, compute the ^{1}H and ^{13}C chemical shifts, scale them, and determine the Boltzmann weighted chemical shifts
4. Compare these chemical shifts with the experimental values using Mean Absolute Error

Source: http://comporgchem.com/blog/?p=3438