COSY (Correlation Spectroscopy)

COSY is a technique for determining correlations through the chemical bond. In its most used form this allows us to see which proton resonances are mutually coupled. As described in the section on 1H spectra, coupling of protons through 2, 3 or 4 bonds has a significant impact on the appearance of a proton spectrum. In simple cases it may be obvious which protons are coupled, however in more complicated molecules such analysis can be almost impossible without recourse to further experiments.

A COSY experiment has two dimensions. This is not the place to describe how this is achieved - any NMR text book would suffice. The result of the experiment is a two dimensional plot with both axes corresponding to the 1D proton spectrum. Peak of interest, known as 'cross-peaks', appear away from the diagonal axis where the two protons are coupled. The spectrum should be symmetrical about the diagonal axis - this can help to confirm if a peak is genuine. Peaks appearing on only one side of the axis may be resulting from 'noise' in the experiment.

TOCSY (TOtal Correlation SpectroscopY) is a slightly different way to approach J-coupling in a molecule. Whereas COSY only reveals short range correlations, TOCSY relies on spin magnetisation being passed on between all protons within the same spin system. As such all protons in a given spin system will show correlations regardless of whether they are themselves coupled to each other. TOCSY is very useful in cases of spectral overlap where standard COSY spectra can leave ambiguities.

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