Measuring methods available and examples of their applications

^{13}C NMR APT (Attached Proton Test)

The Attached Proton Test (APT) experiment is a simple method to assign C-H multiplicities in ^{13}C NMR spectra. It provides information on all carbon muliplicities within a single experiment.
The APT (or J-resolved) experiment yields methine (CH) and methyl (CH3) signals negative and quaternary (C) and methylene (CH2) signals positive (In North America, oposite phasing is usually used). It is slightly less sensitive than DEPT but a single experiment shows all carbon signals at once unlike DEPT which needs three different spectra.
Even though this technique does not distinguish fully between CH_n groups, it is so easy and reliable that it is frequently employed as a first attempt to assign peaks in the spectrum and elucidate the structure. It is sometimes possible that a CH and CH_2 signal have coincidentally equivalent chemical shifts resulting in signal cancelation in the APT spectrum due to the opposite phases. For this reason the conventional $^{13}C\{^1H\}$ spectrum or HSQC are usually also acquired.

Examples of APT spectra

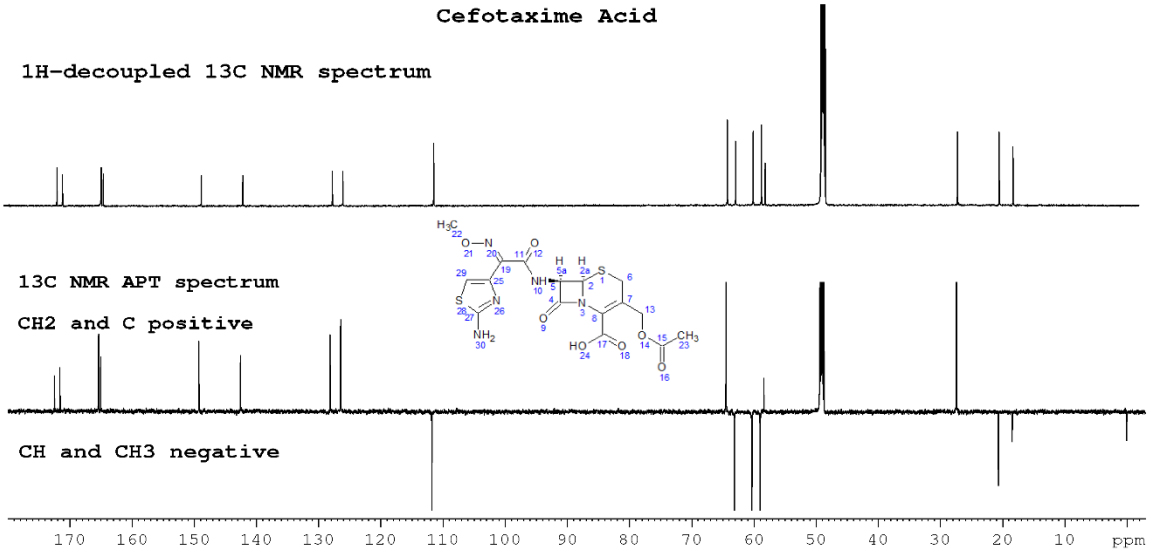

Fig. 1. Cefotaxime Acid (cephalosporin antibiotic of third-generation). **APT spectrum of Cefotaxime showing CH and CH_3 negative while CH_2 and C are positive.** Spectrometer: AVANCE III HD 700, Probehead: 5 mm CPTXO 13C/15N-1H/D with z gradients, Experiment time: 12 min

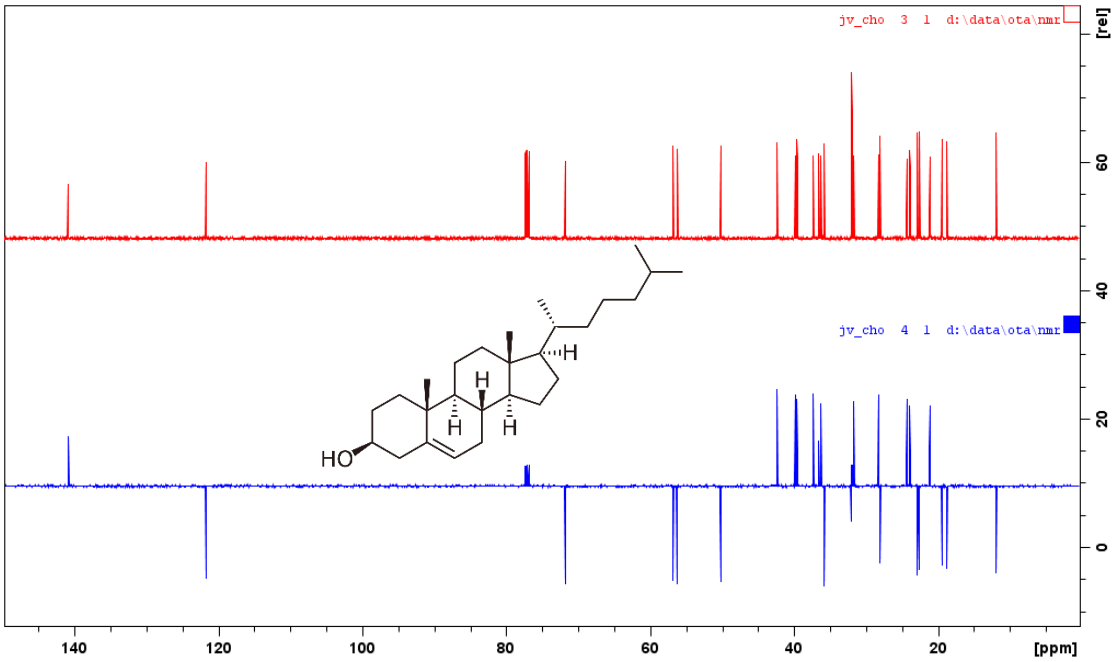

Fig. 2. Comparison of the ^{13}C NMR spectra with proton decoupling (red) and APT experiment for the molecule of cholesterol. APT spectrum shows CH and CH_3 negative while CH_2 and C are positive.