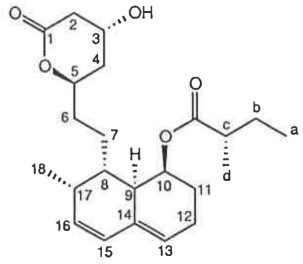
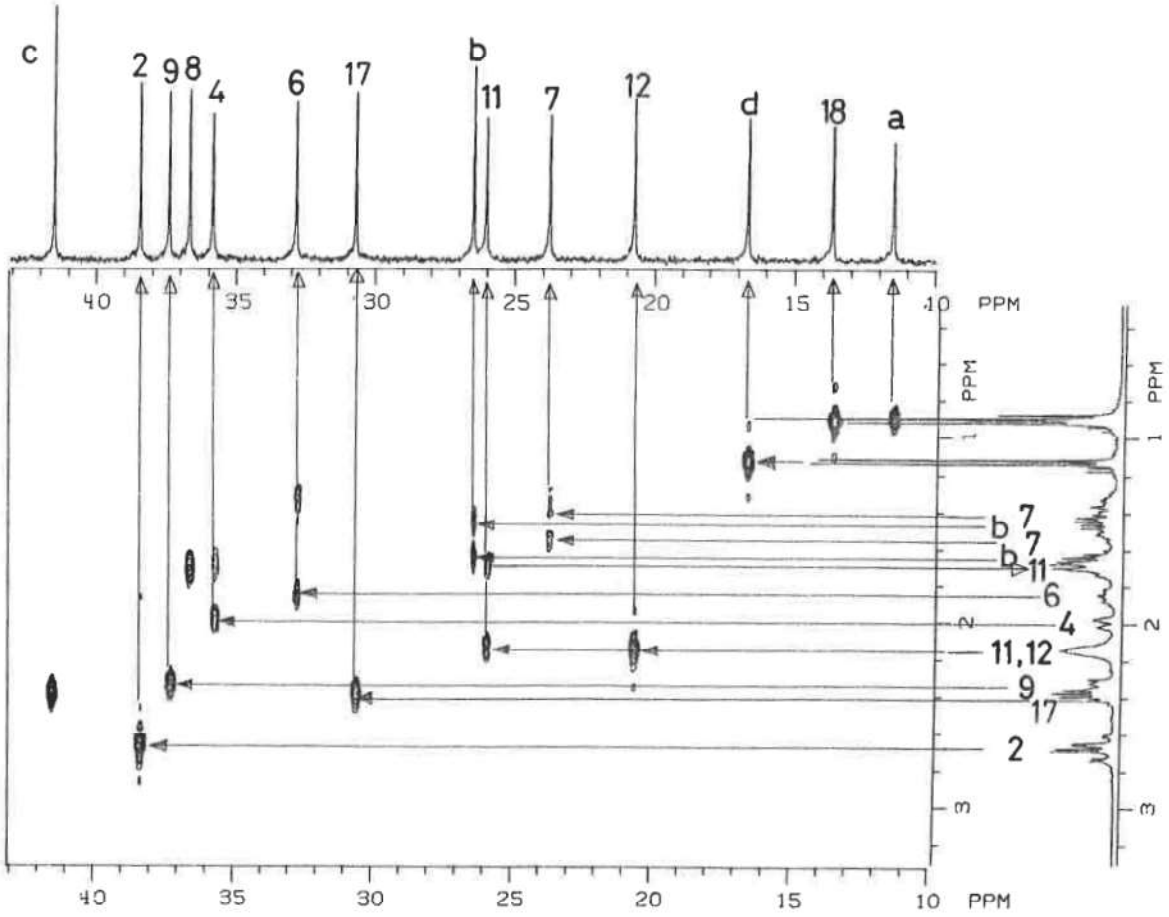
PROBLEM SET 6, Phcg 631

1) Assign the ^{1}H-^{13}C cross-peaks in the single bond ^{13}C-correlated heteronuclear spectrum below of Compactin. The ^{13}C signals 7, 11, b, 6 and 4 show two cross-peaks, because there are two nonequivalent ^{1}Hs on each carbon. Based on ^{1}H correlations, ambiguity can be seen between $^{1}H11$ and $^{1}H12$. Only one cross-peak is seen since the two ^{1}Hs on the $^{13}C12$ are equivalent and appear as a broad singlet at 2.15 ppm. When the cross-peak of carbon signal 11 is examined, it is seen that the 11-methylene ^{1}Hs have different chemical shifts, but one still overlapping the 12 signal.

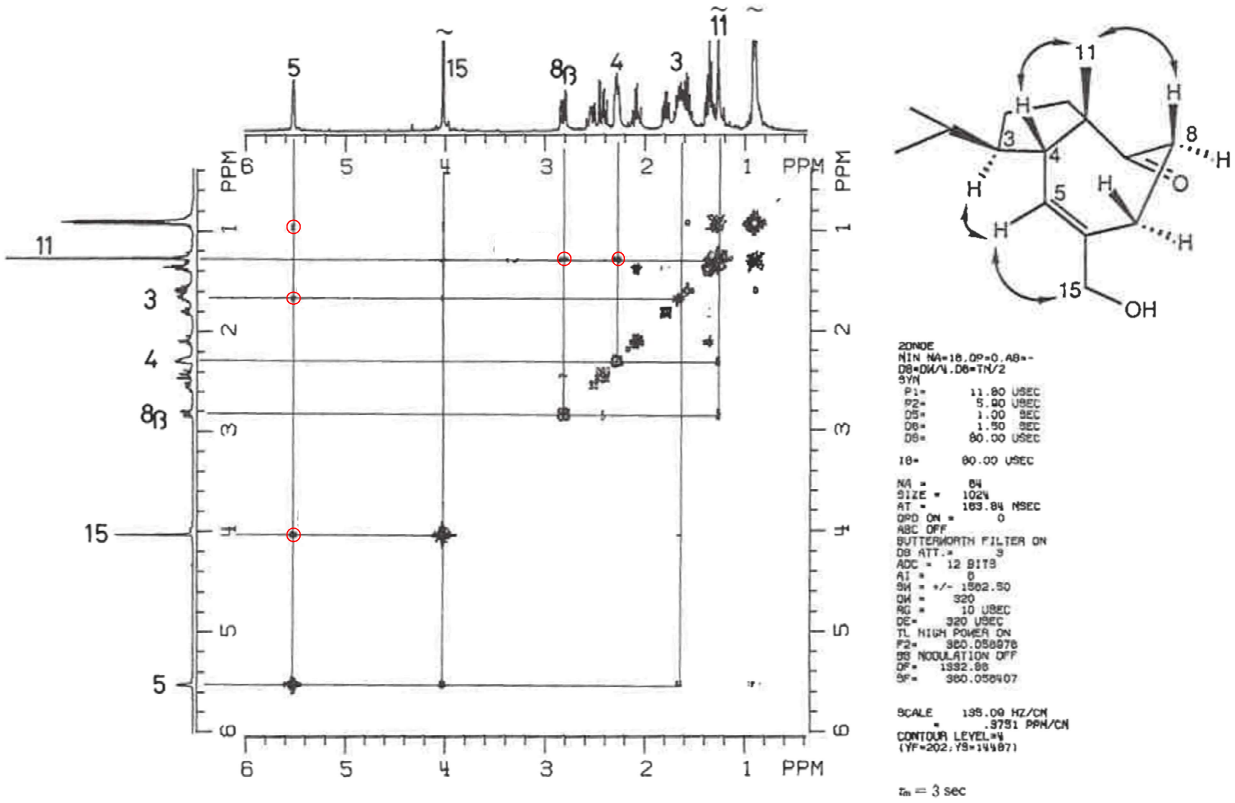




90MHz ^{13}C-NMR ($CDCl_3$) [TI][1]

2) Make a Table of ^{1}H and ^{13}C chemicals shifts of Compactin based on the assigned ^{1}H-^{13}C cross-peaks in the single-bond ^{13}C-correlated heteronuclear spectrum of the previous exercise.

3) Assign the NOE cross-peaks circled in red in the ^{1}H-^{1}H NOESY spectrum of Aphanamol-I.

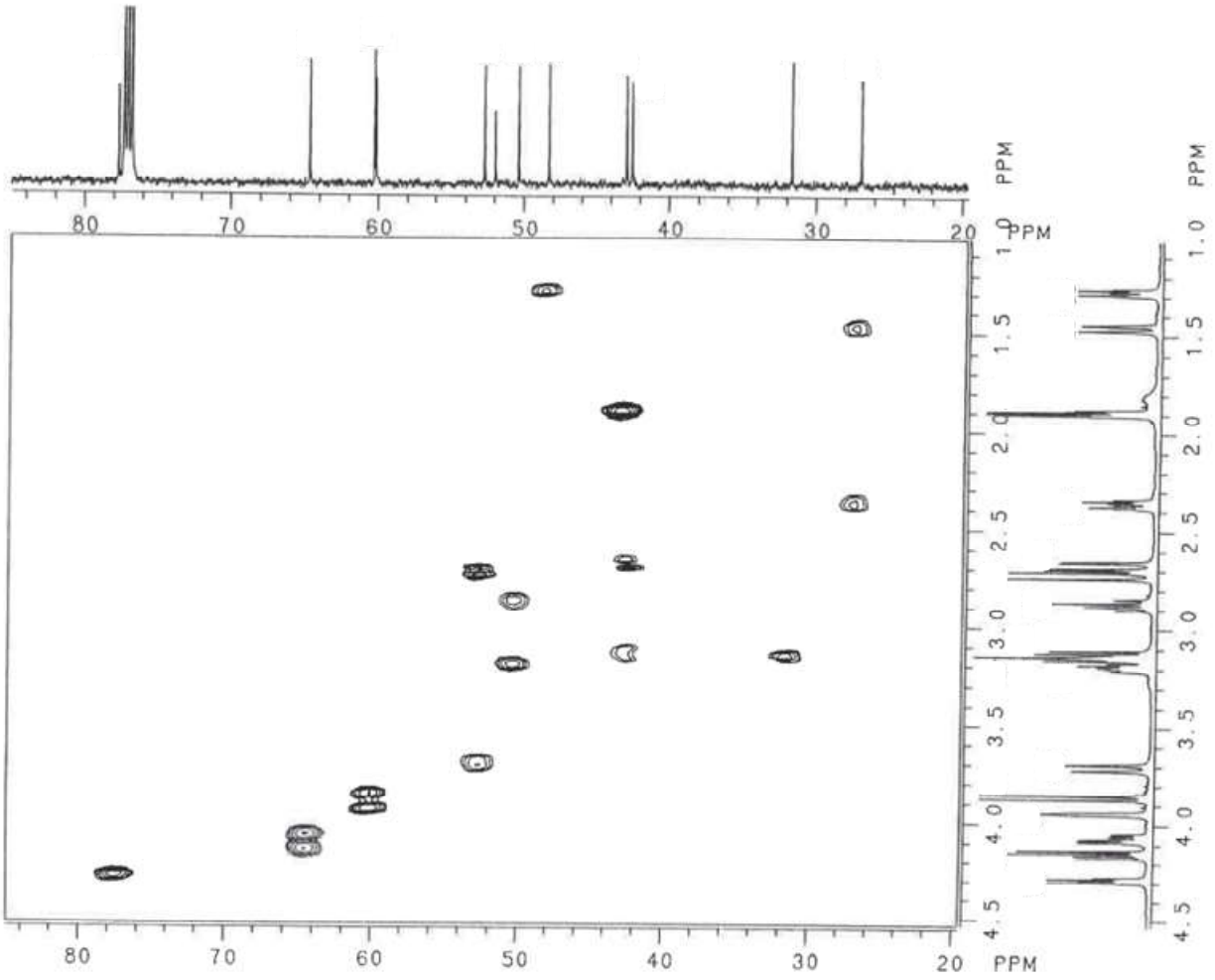


360MHz ^{1}H-NMR ($CDCl_3$) [TI]

4) Complete the Table of NOE.

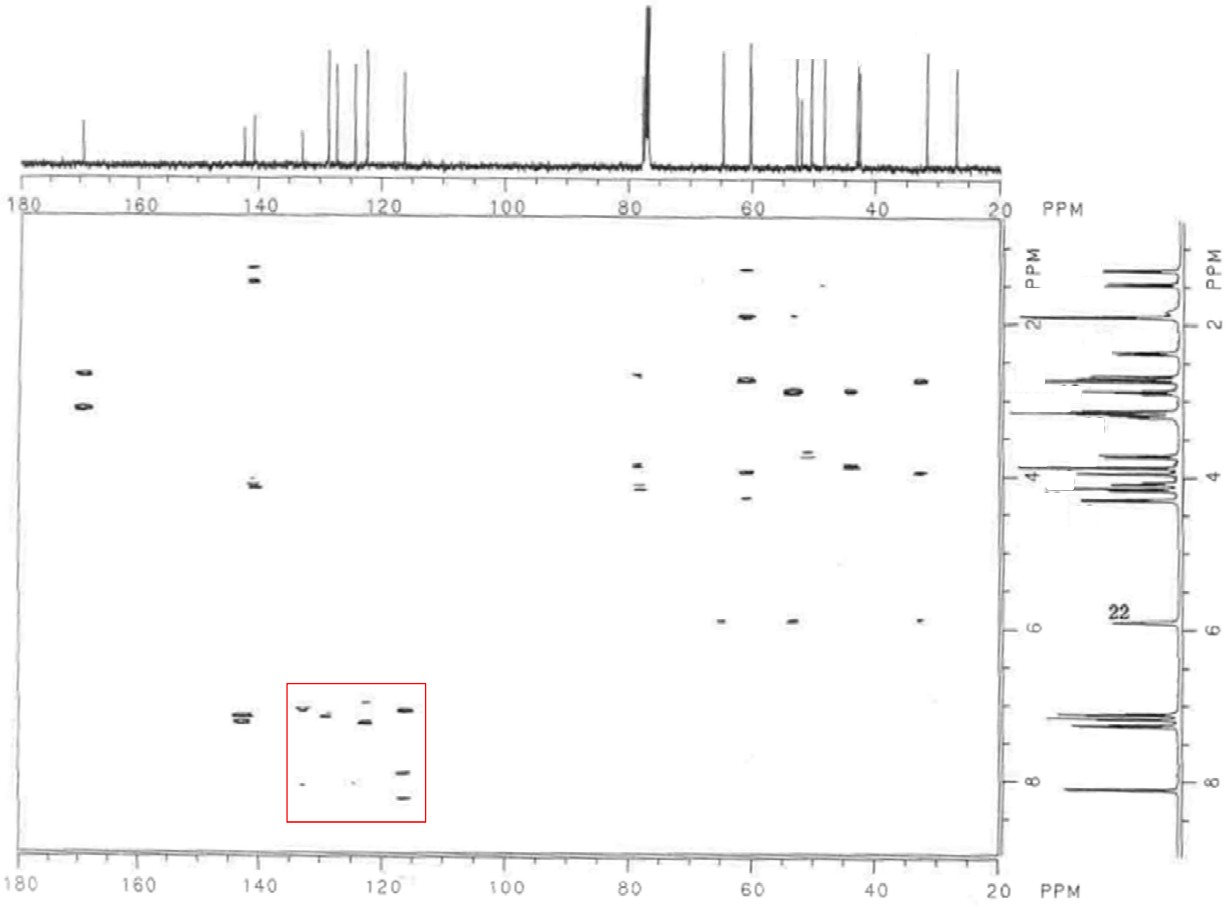
NOE cross-peak	^{1}H - chemical shift	^{1}H - chemical shift

5) Based on the full ^{1}H assignment made by ^{1}H-^{1}H COSY, ^{1}H-^{1}H TOCSY and ^{1}H-^{1}H NOESY of Strychnine in the Problem Set 4 of this course (answers are given at the end of this material), assign the 1D signals (on both dimensions) and the 2D cross-peaks of the its ^{13}C-HMQC spectrum below.



500 MHz ^{1}H-NMR ($CDCl_3$) [TI]

6) Based on the previous ^{1}H and ^{13}C assignments of Strychnine, assign the 1D signals (on both dimensions) and the 2D cross-peaks of the its ^{13}C-HMBC spectrum below. Assignments for the 2D cross-peaks and their related 1D signals shown inside the red square are not necessary.



500 MHz ^{1}H-NMR ($CDCl_3$) [TI]

6) Make a Table (complete as possible) of ^{1}H and ^{13}C chemical shifts for the most resonances assigned in the series of 2D ^{1}H-^{1}H and ^{1}H-^{13}C spectra of Strychnine.

7a) Explain briefly how the NMR RDC technology can complement the NMR NOE technology? 7b) Give the major Pros and Cons of each technology.

8) Why dipolar couplings are not observable measurements at the isotropic conditions?

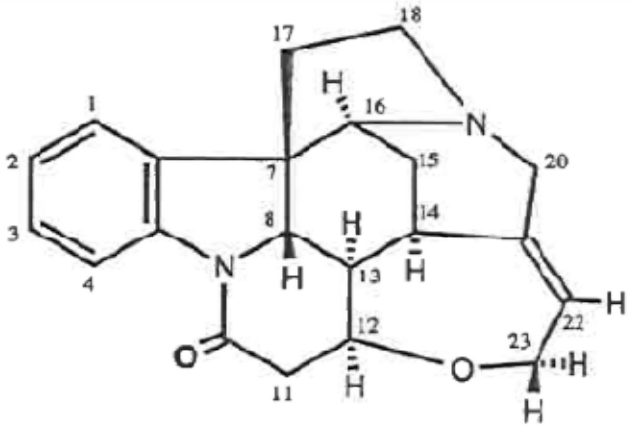
9a) How to make the nuclear dipole-dipole interactions observable so that they can be properly measured through NMR? 9b) Explain why these measurements are not obtained by solid-state NMR?

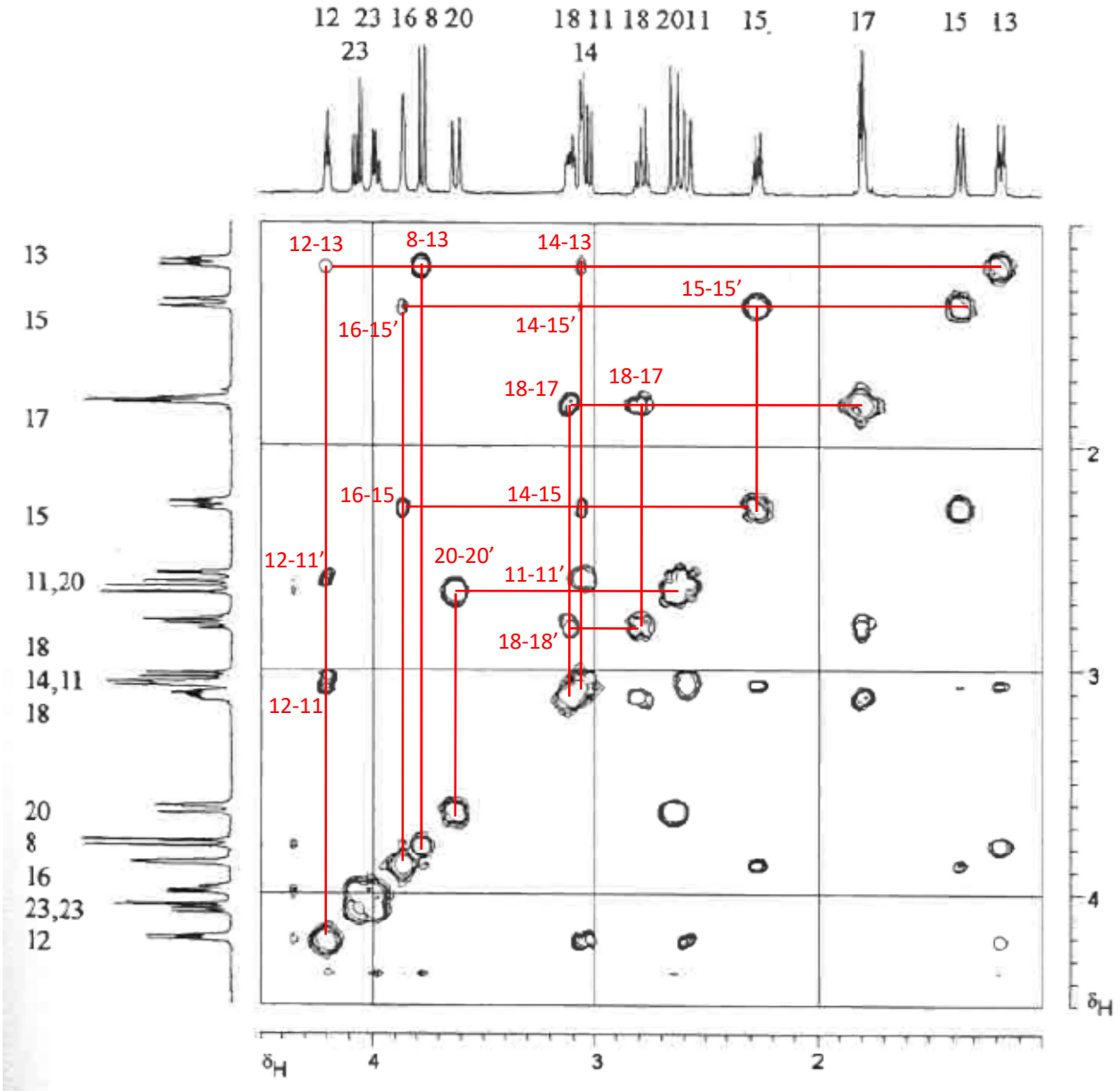
10) Explain experimentally how to get accurately RDC values?

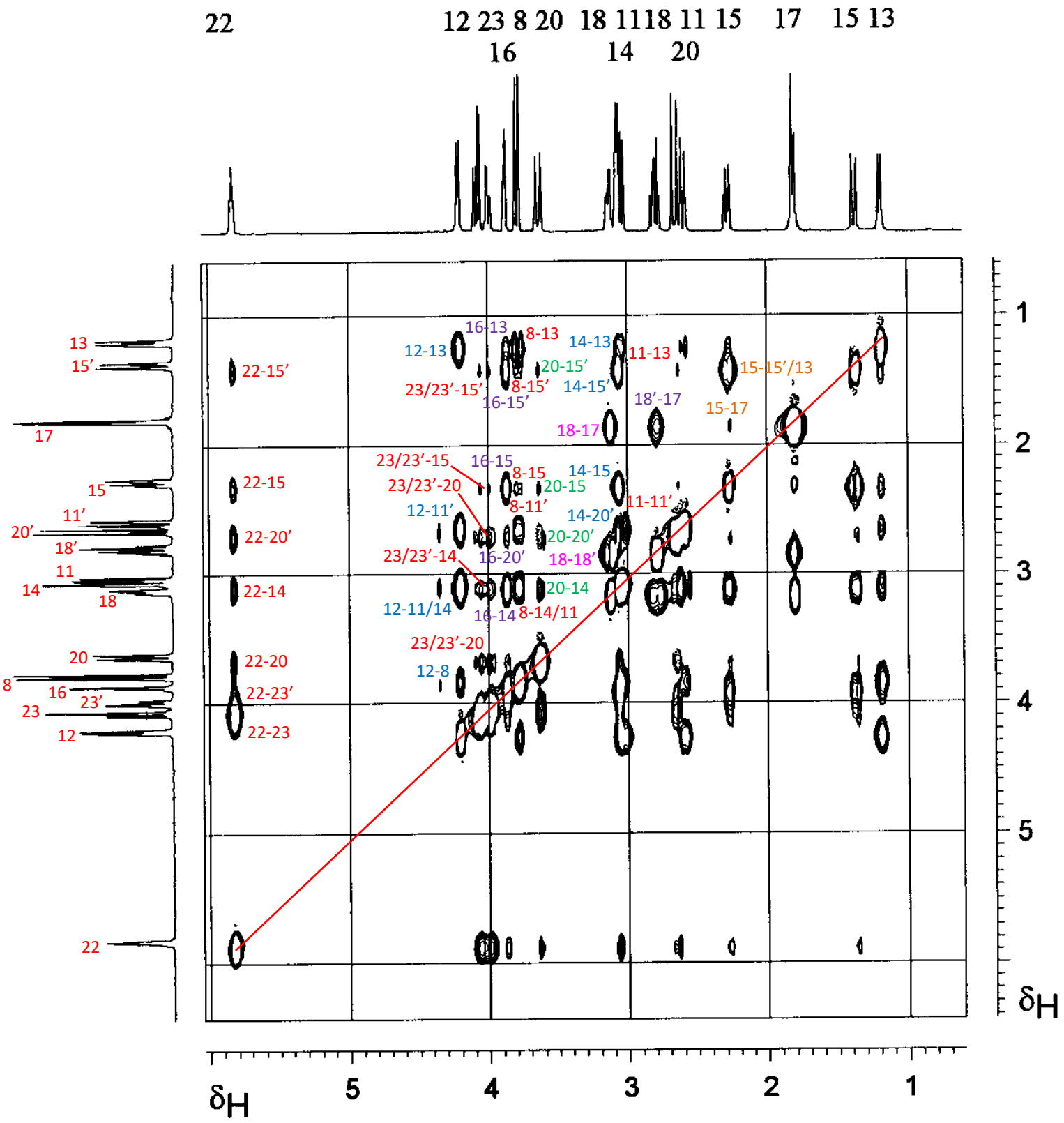
11a) How can we ensure that the alignment has been created in our sample? 11b) How can we ensure that the alignment obtained is not impacting on the natural conformation of the studied molecule?

12) What is the other component created at the anisotropic NMR condition and explain briefly its origin?

PROBLEM ANSWERS 4, Phcg 631



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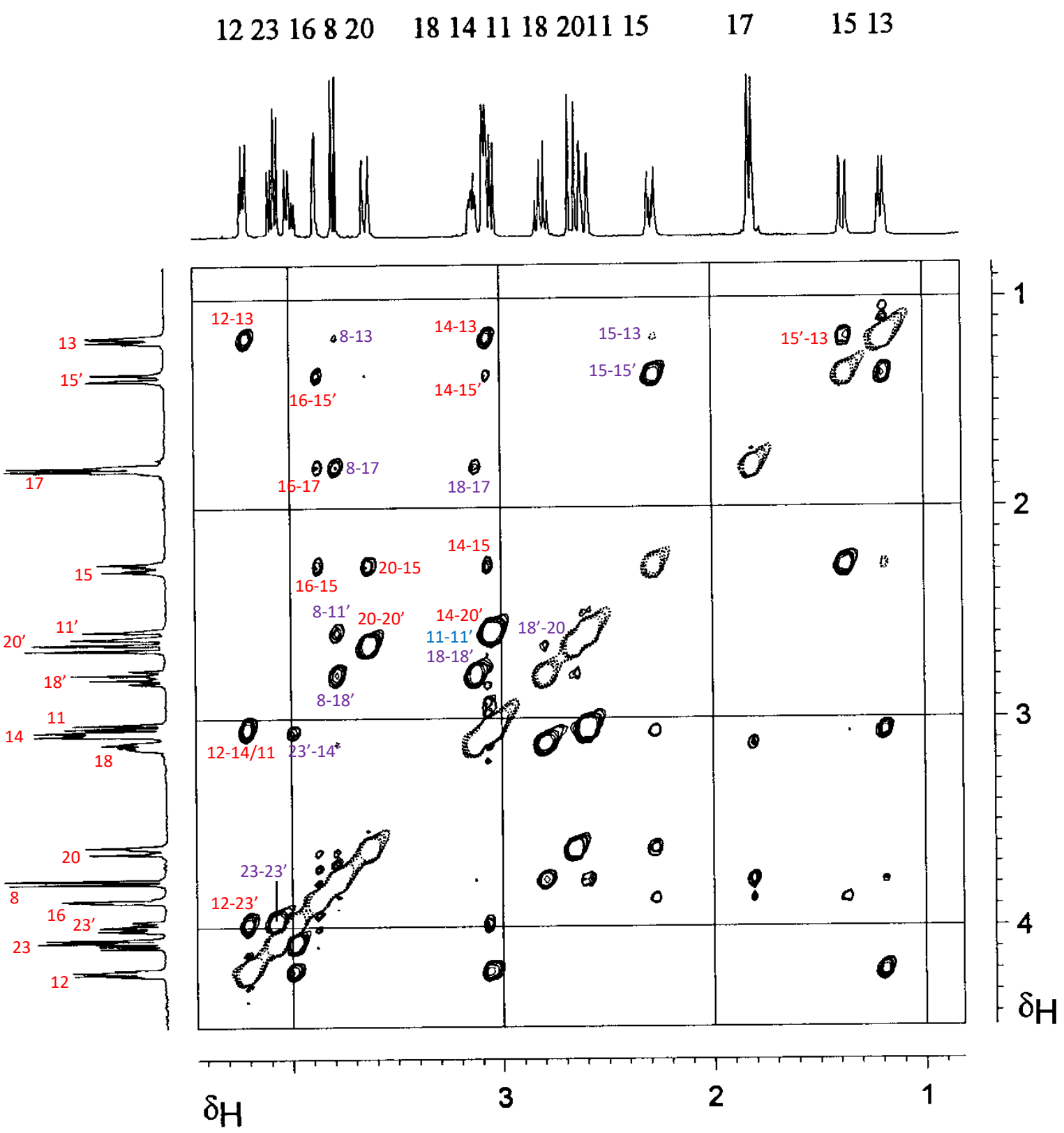
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