

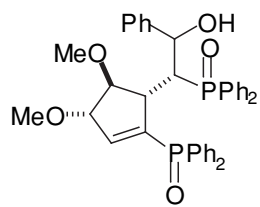
Supporting information

A New Methodology for Synthesis of A Chiral Phosphinocarboxylic Acid Through Michael Cyclization-Aldol Tandem Reaction of Chiral α,β,γ,ψ -Unsaturated Bisphosphine Oxide and Application in Palladium-Catalyzed Asymmetric Allylic Alkylation

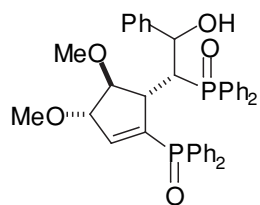
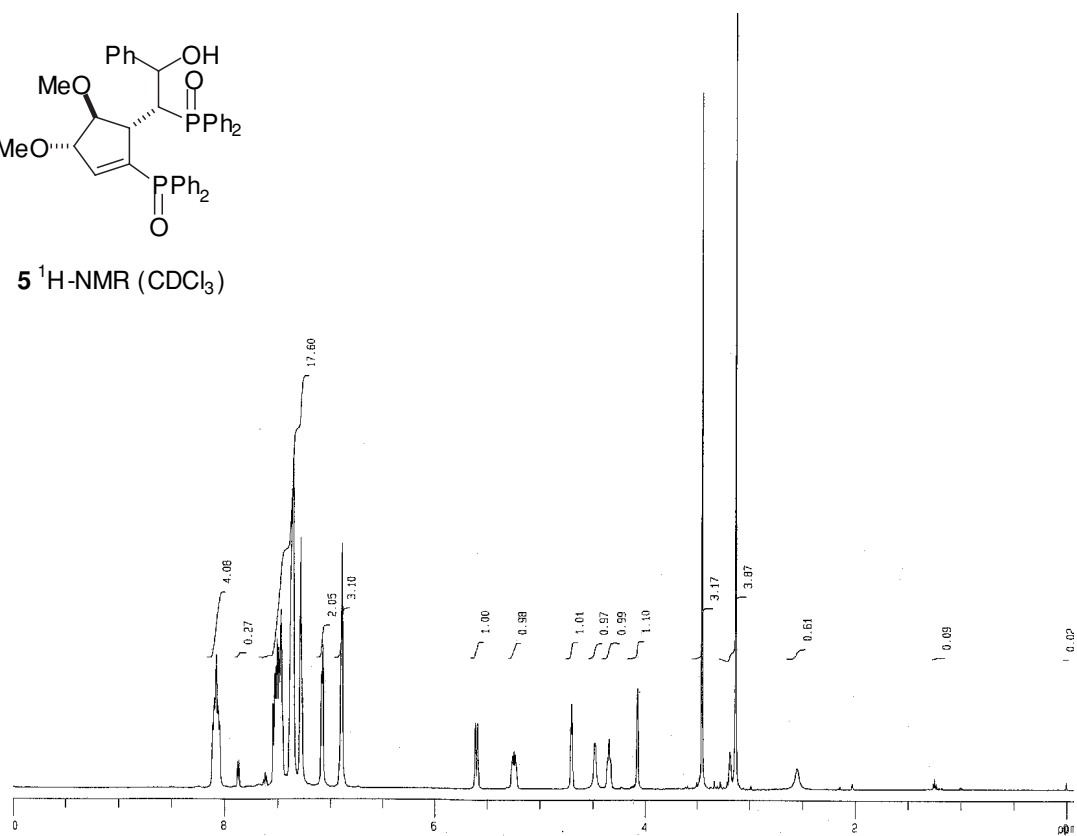
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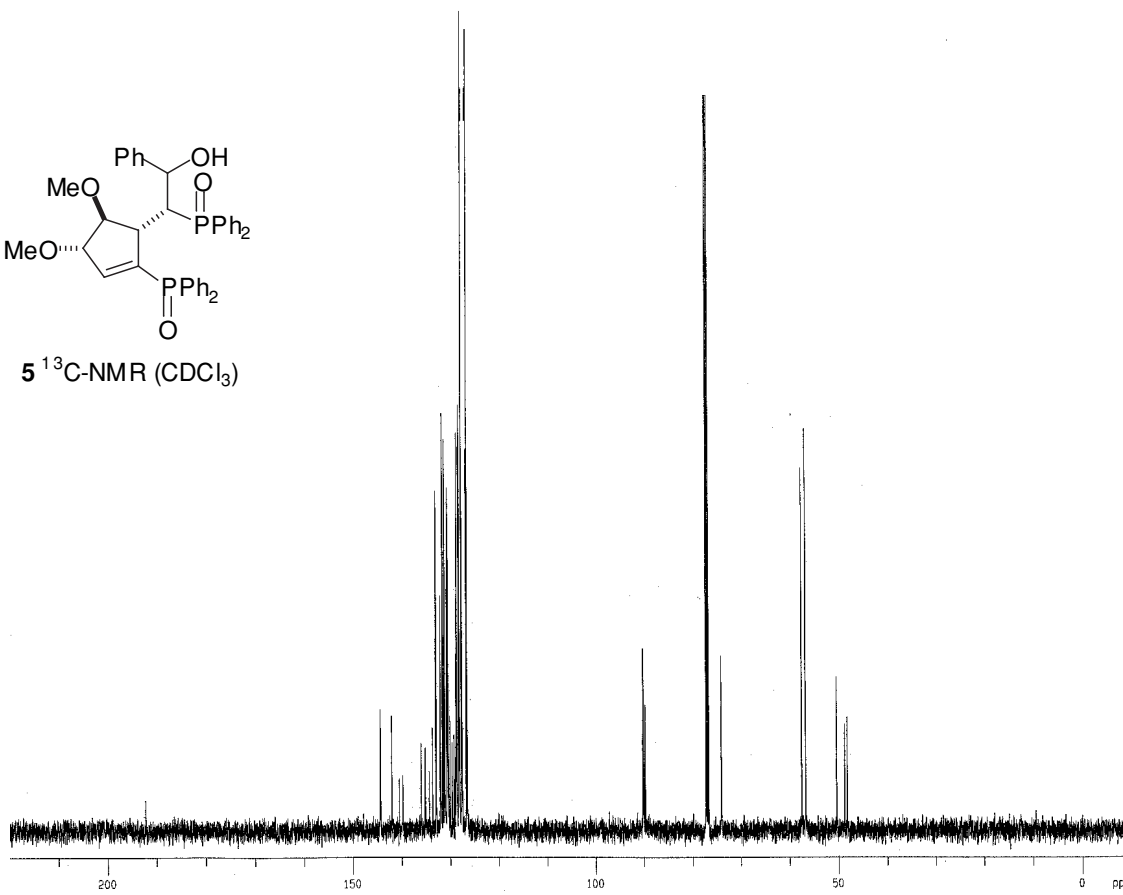
General. ¹H-, ¹³C- and ³¹P-NMR spectra were taken with a JEOL EX-500 spectrometer at 500, 126 and 202 Hz in CDCl₃. Chemical shift values are expressed in ppm relative to internal tetramethylsilane and external 85% H₃PO₄ for ³¹P.

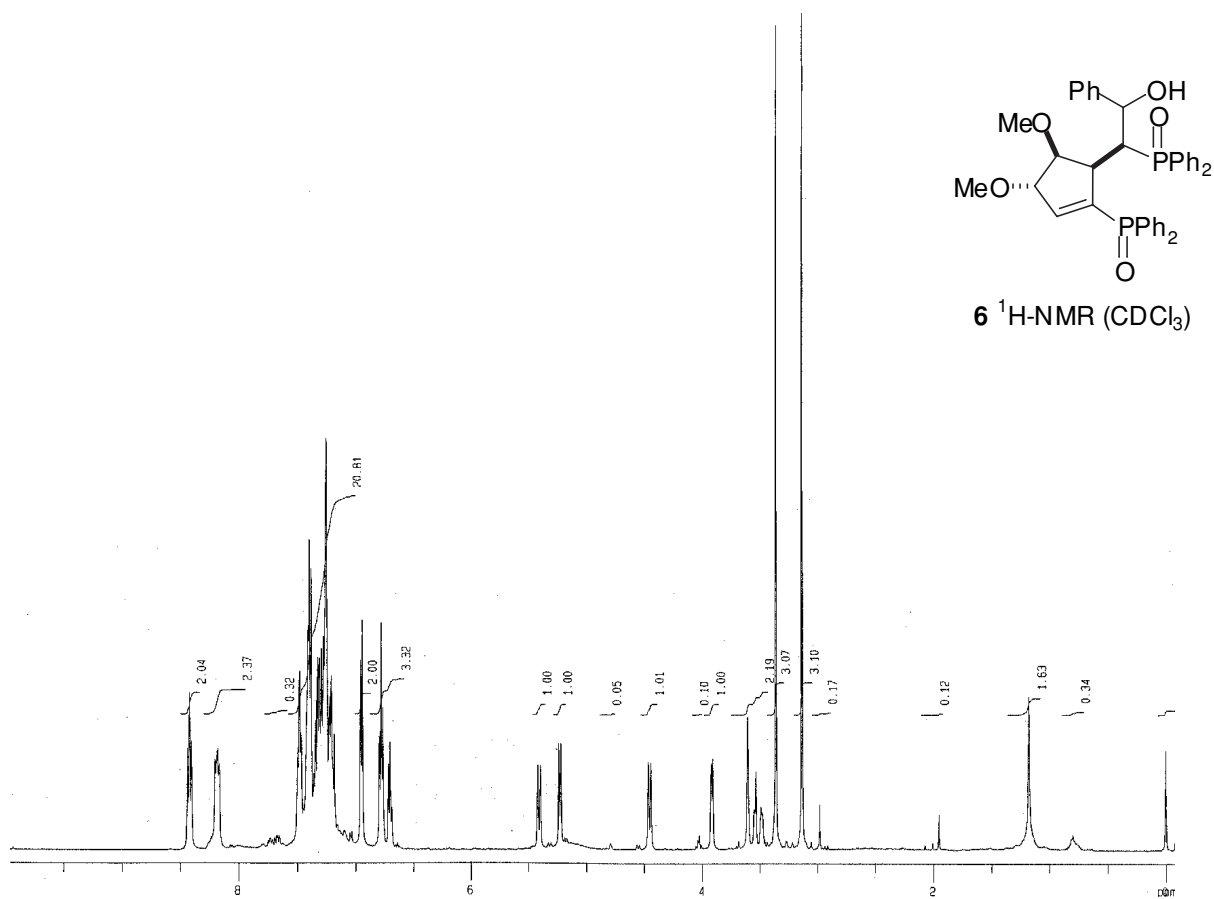
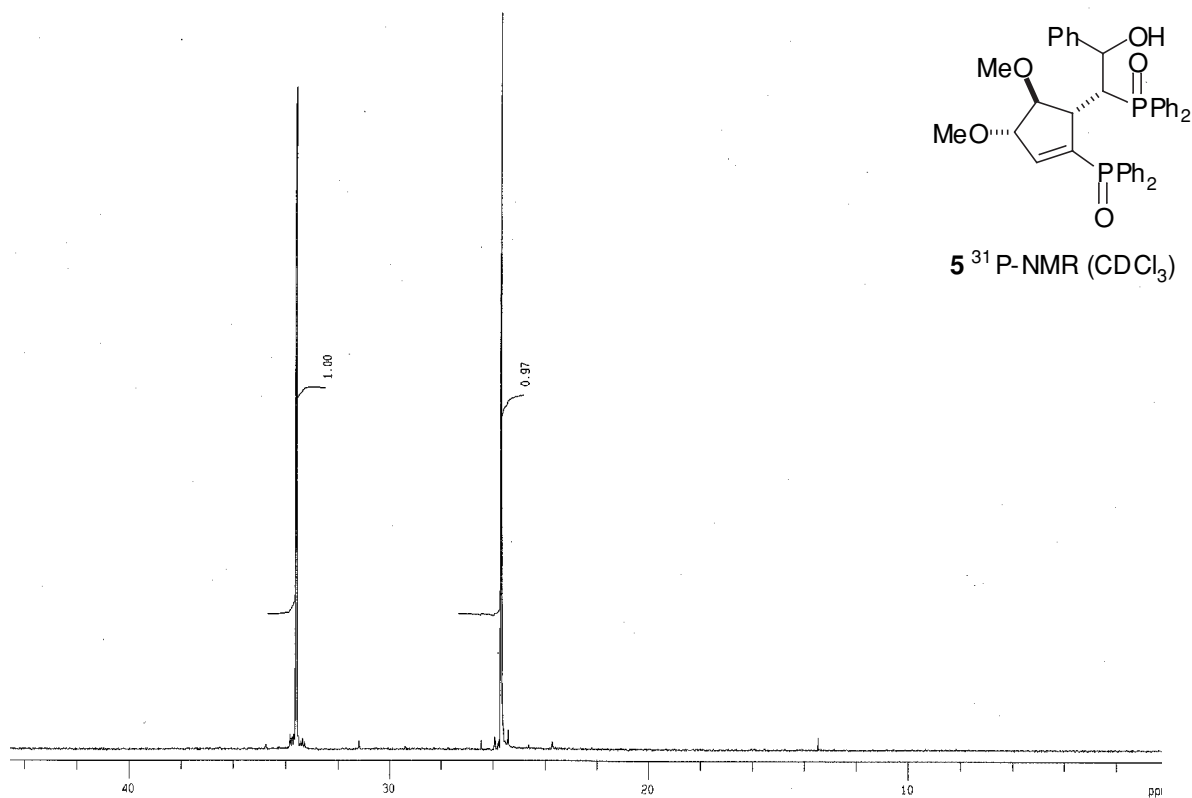


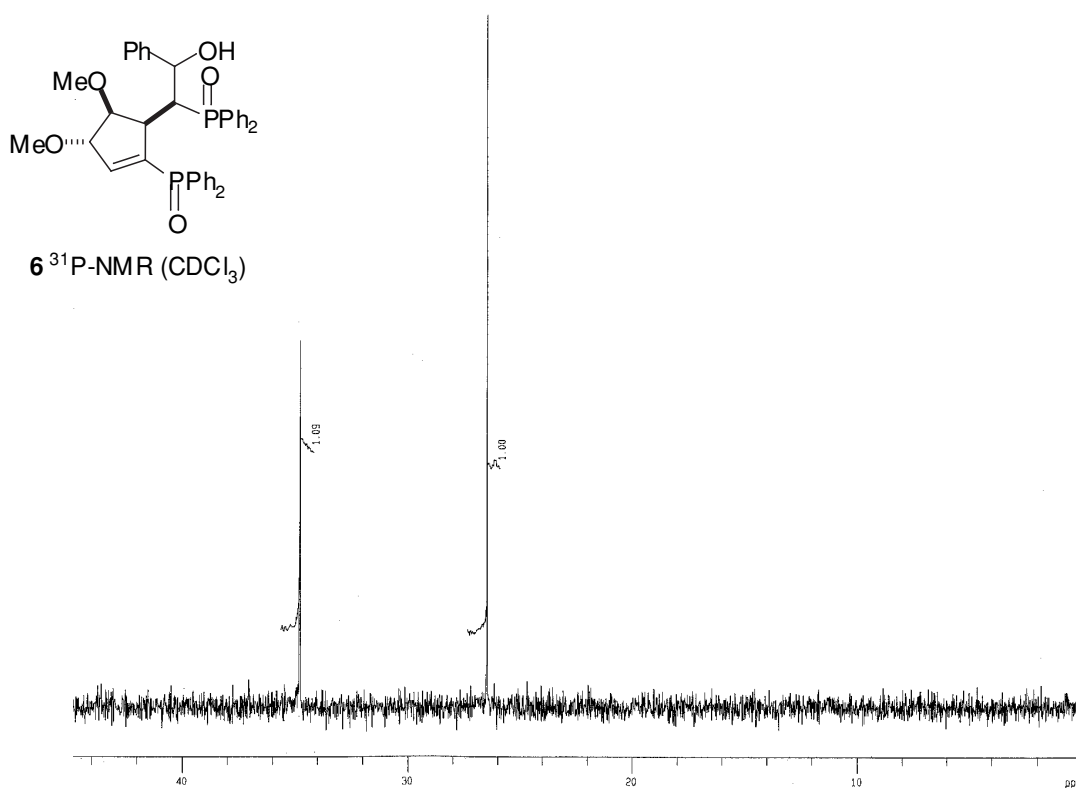
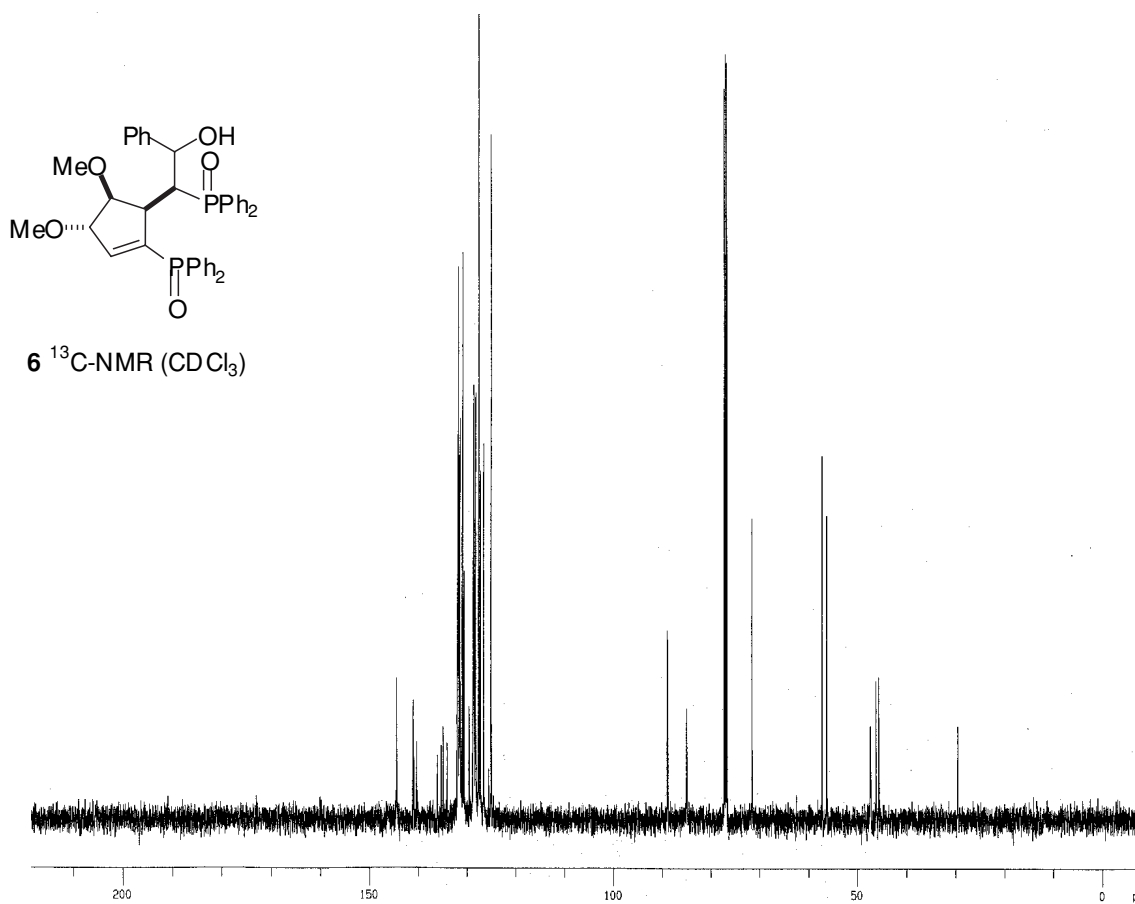
5 $^1\text{H-NMR}$ (CDCl_3)

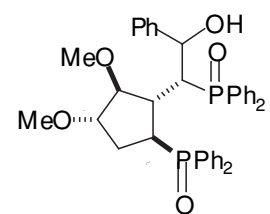


5 $^{13}\text{C-NMR}$ (CDCl_3)

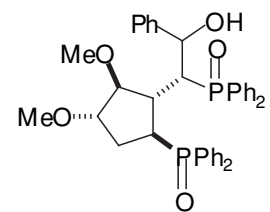
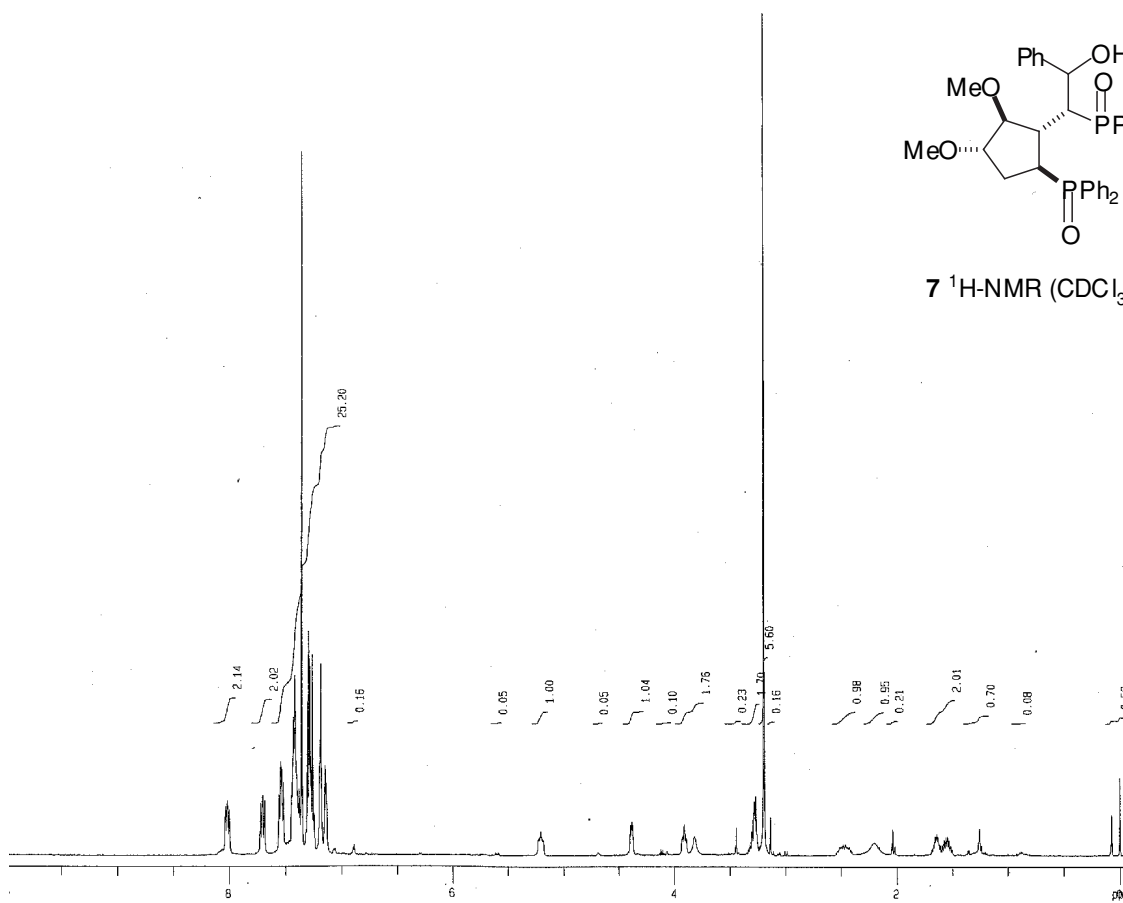




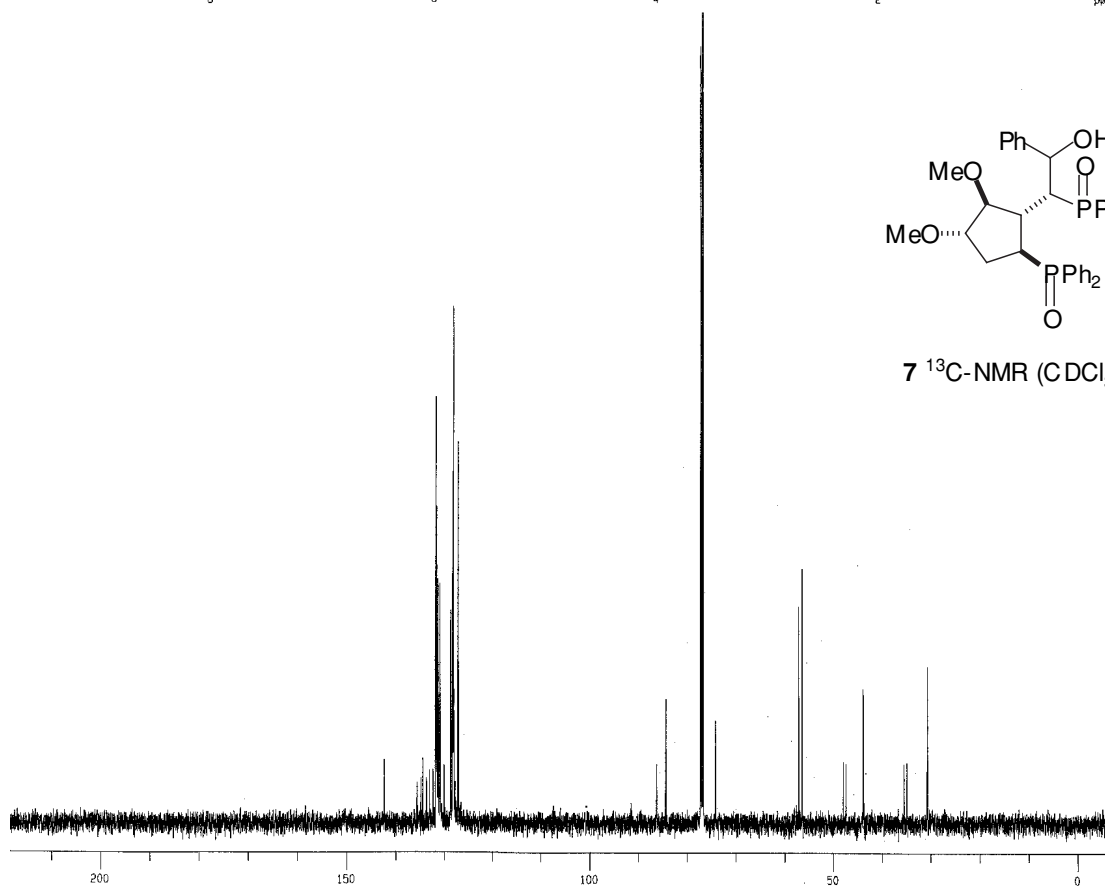


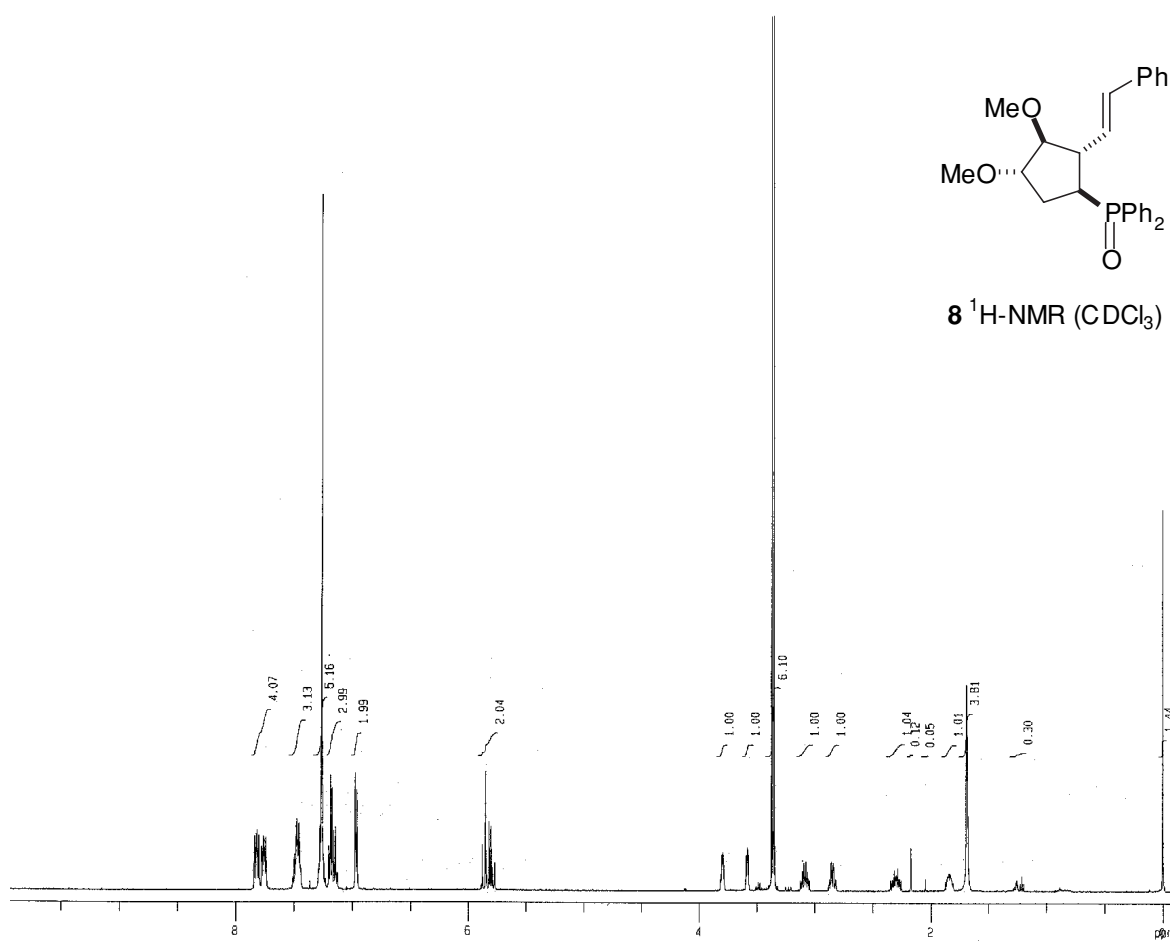
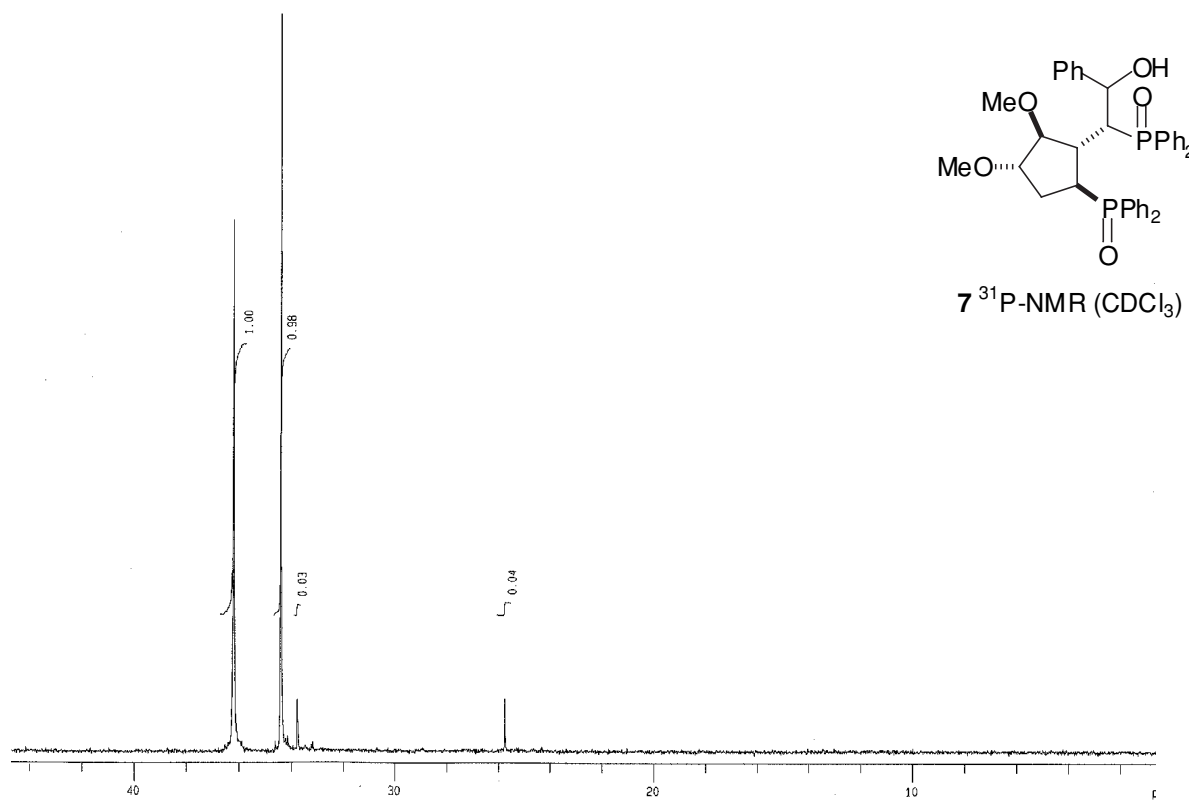


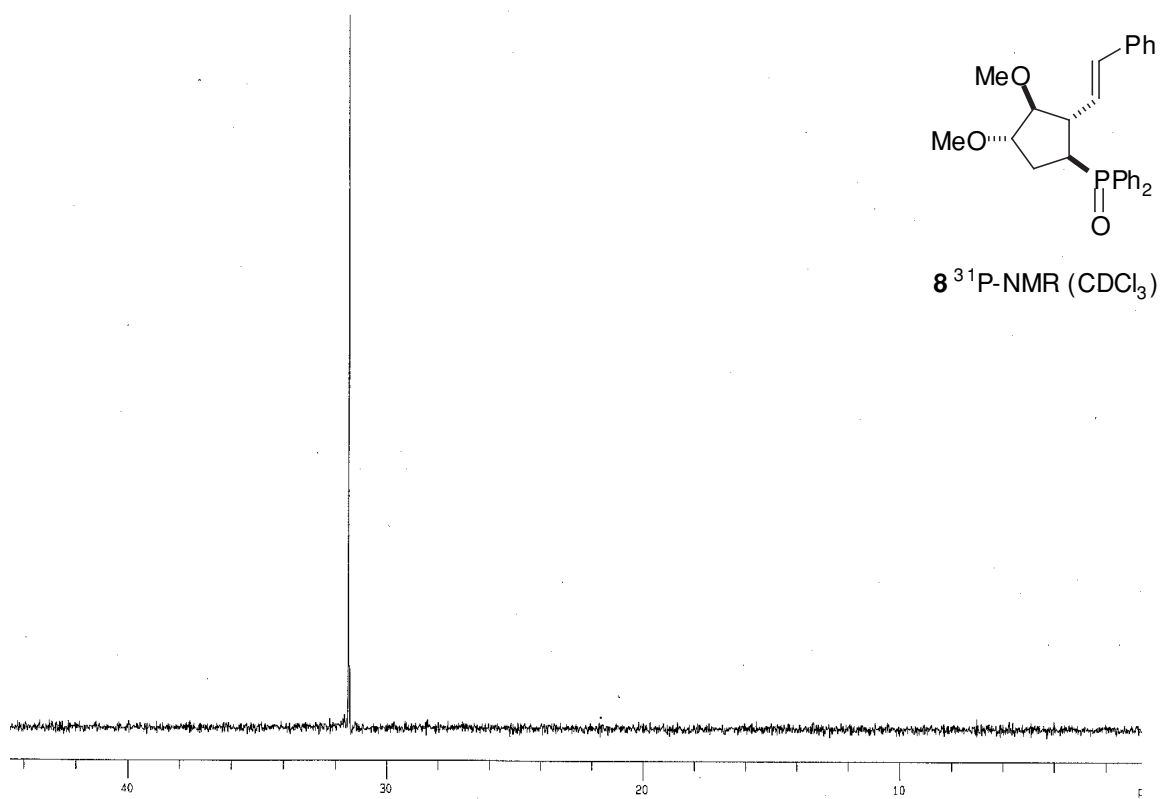
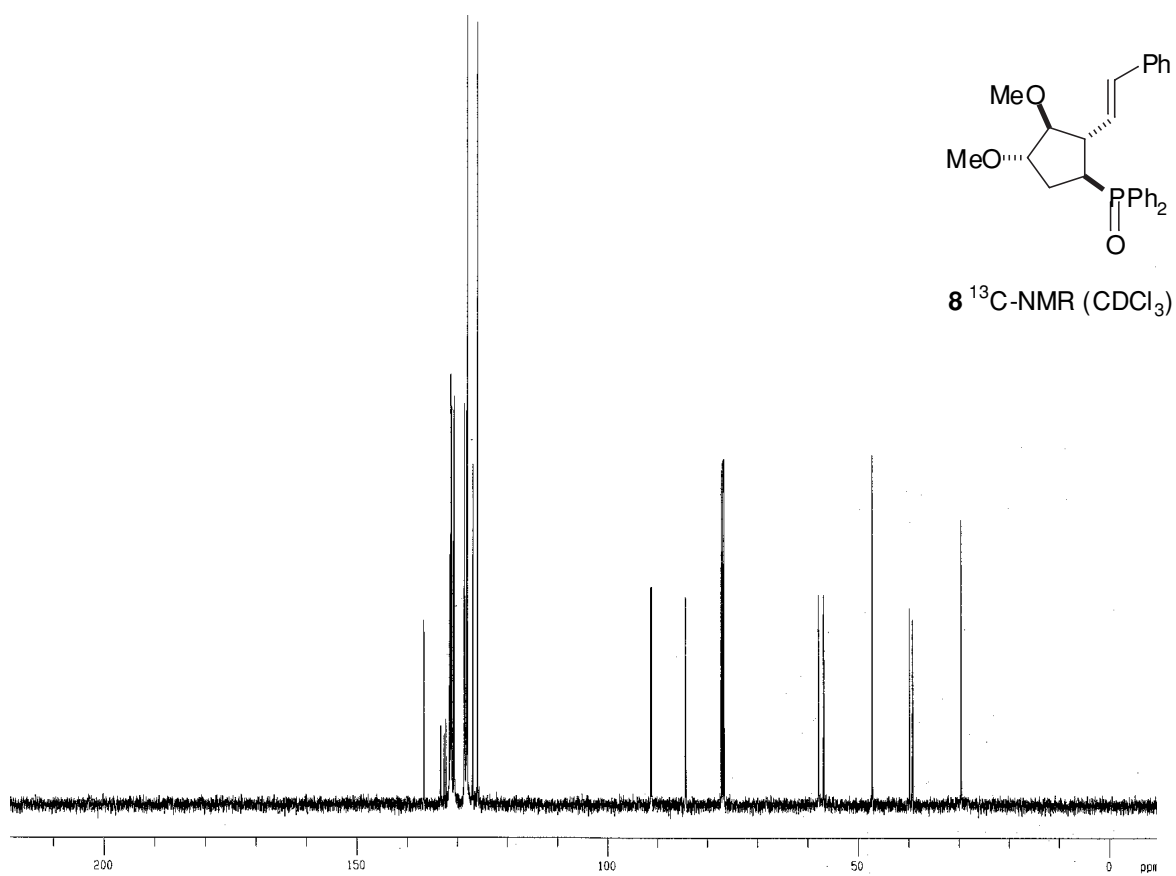
7 $^1\text{H-NMR}$ (CDCl_3)

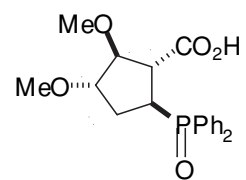


7 $^{13}\text{C-NMR}$ (CDCl_3)

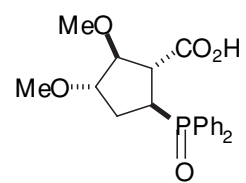
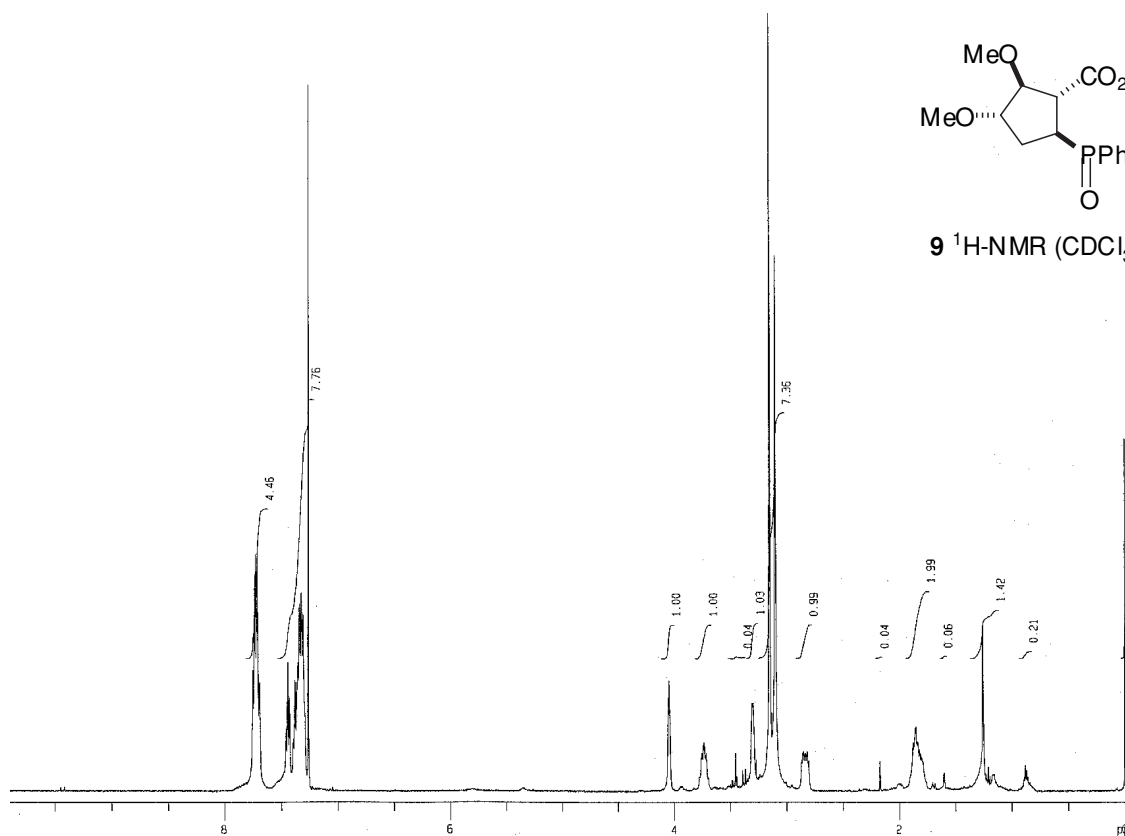




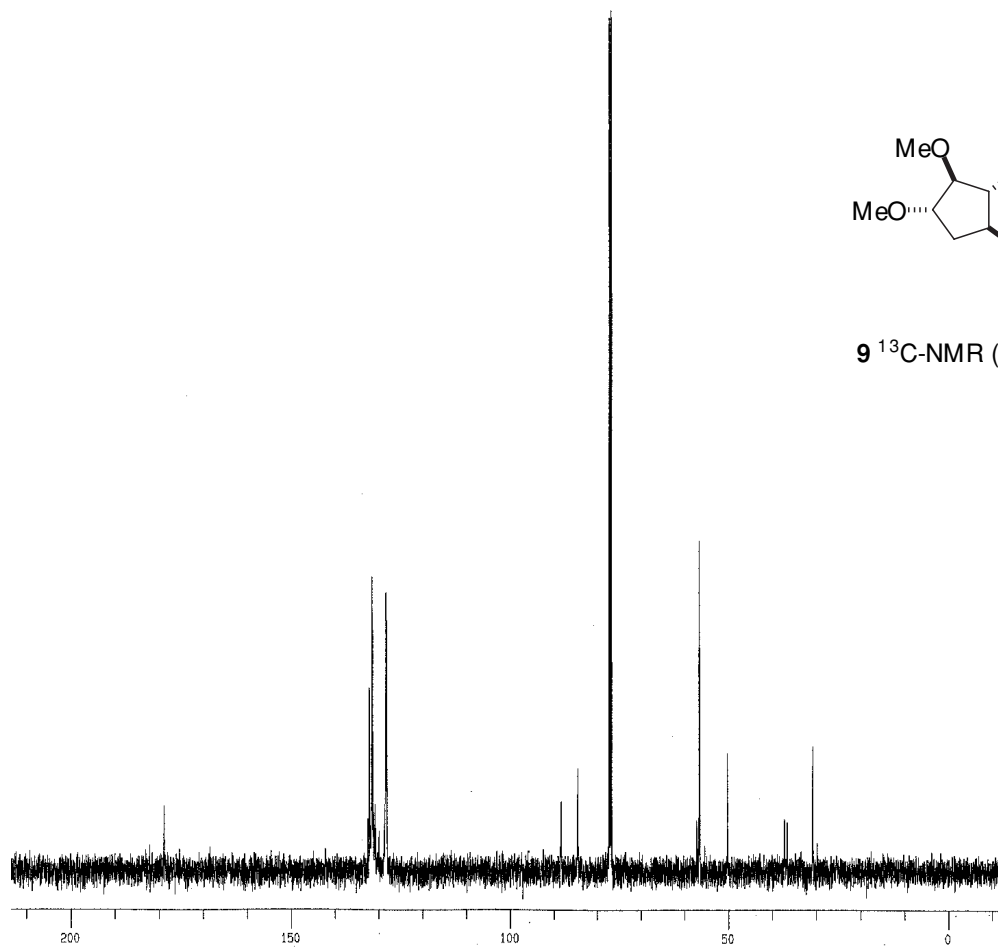


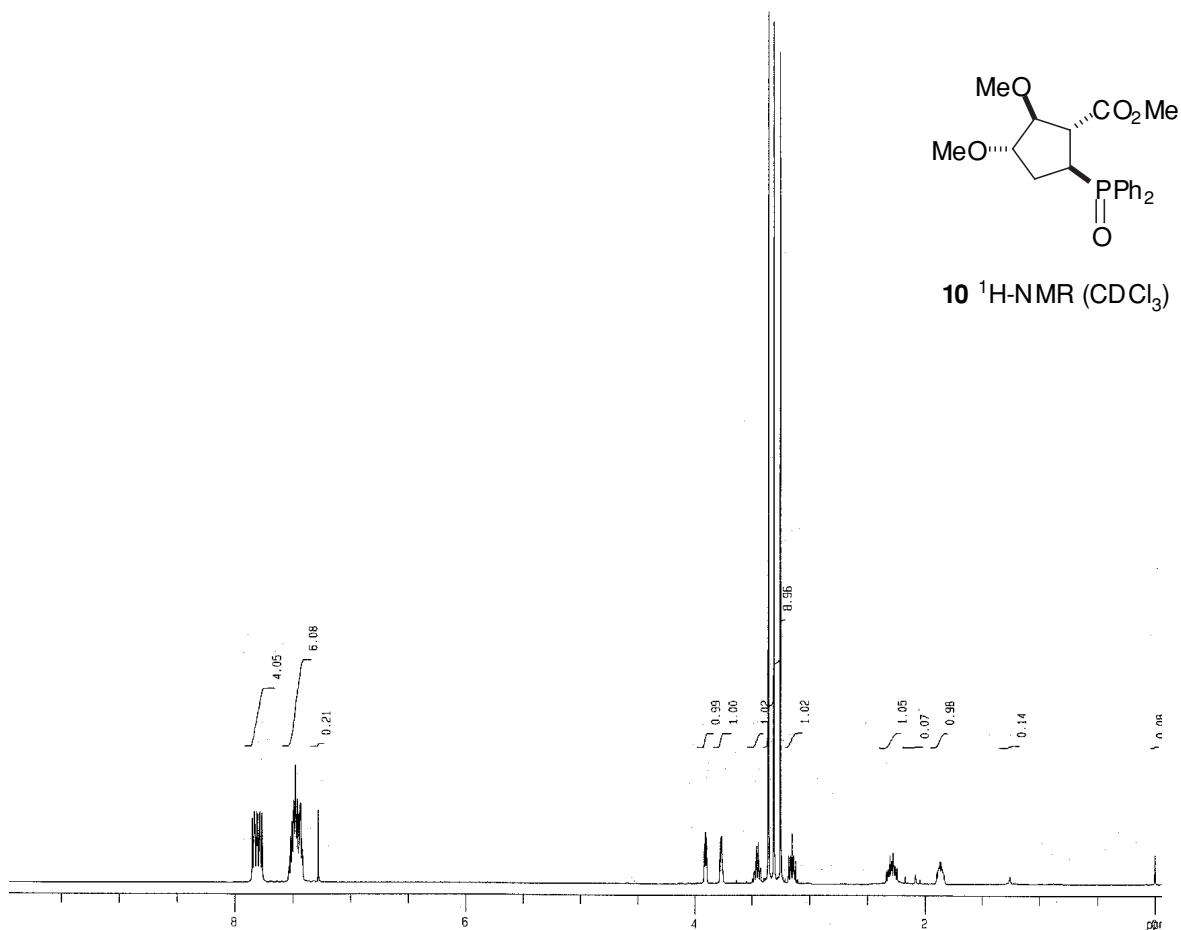
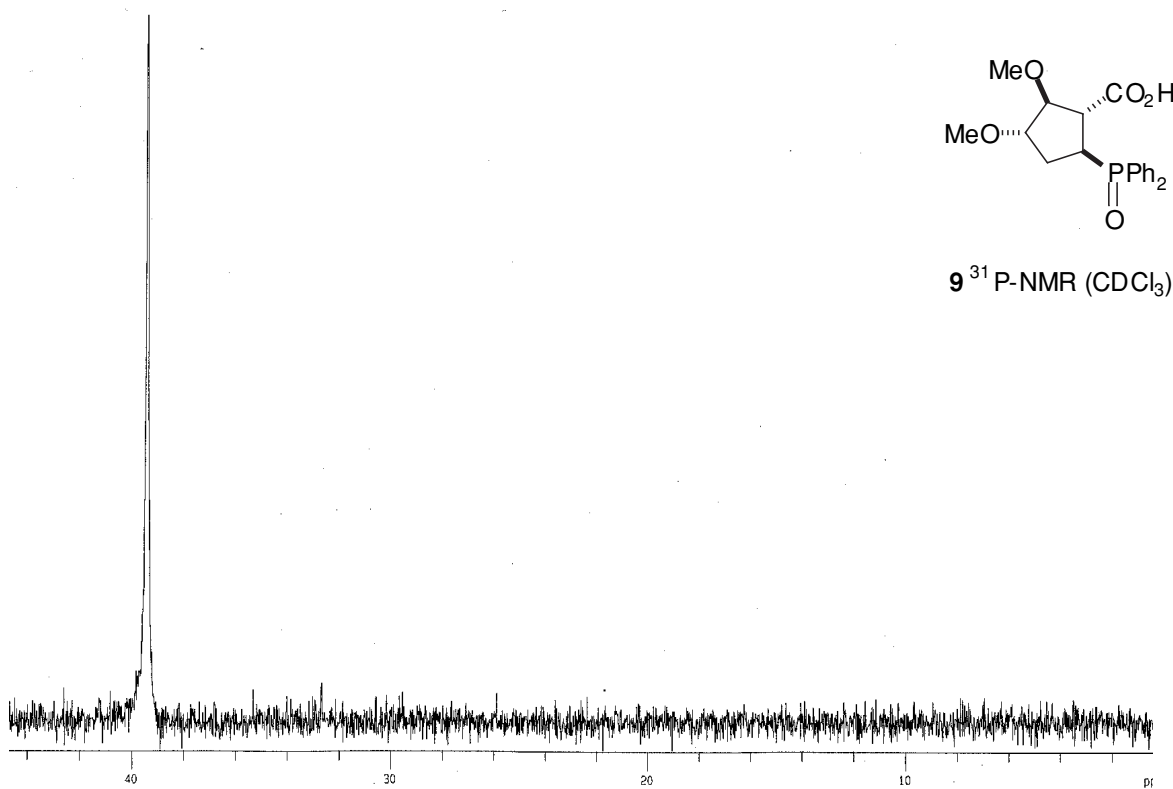


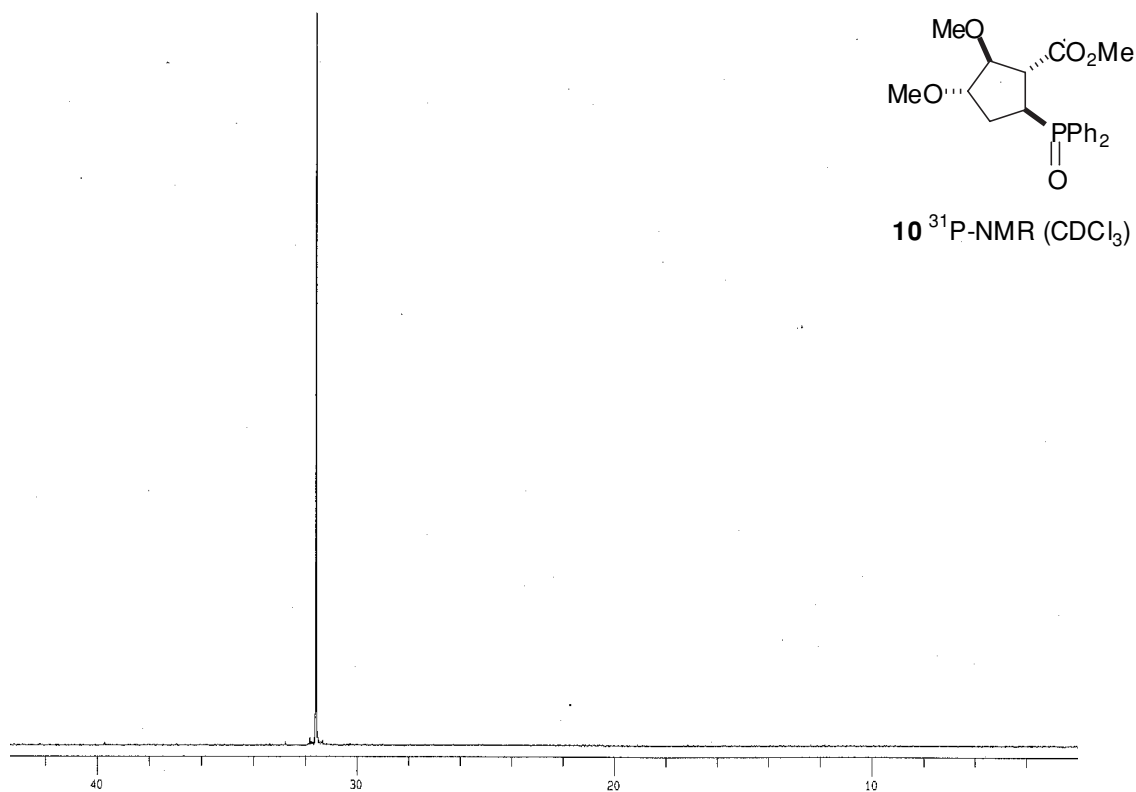
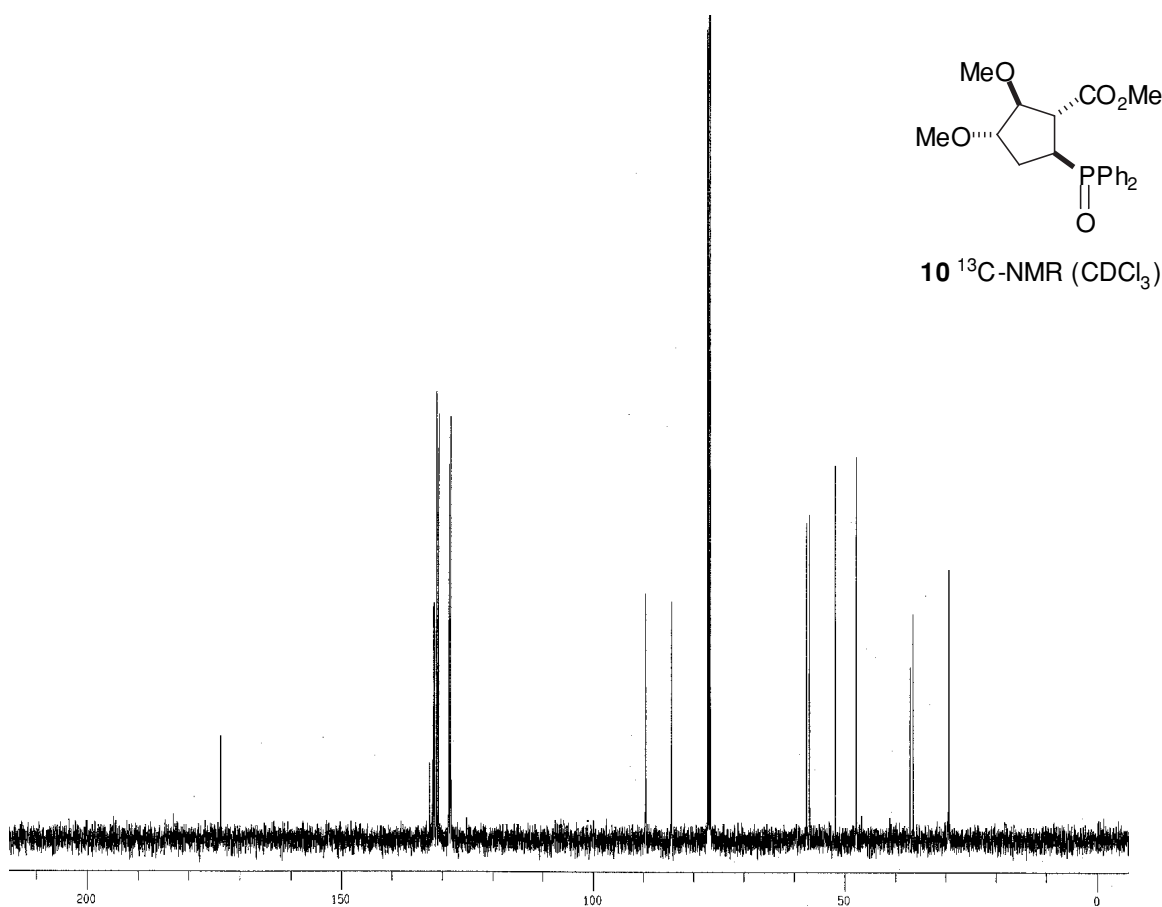
9 $^1\text{H-NMR}$ (CDCl_3)

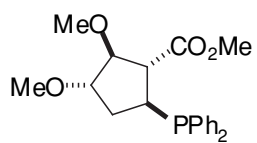


9 $^{13}\text{C-NMR}$ (CDCl_3)

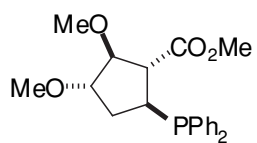
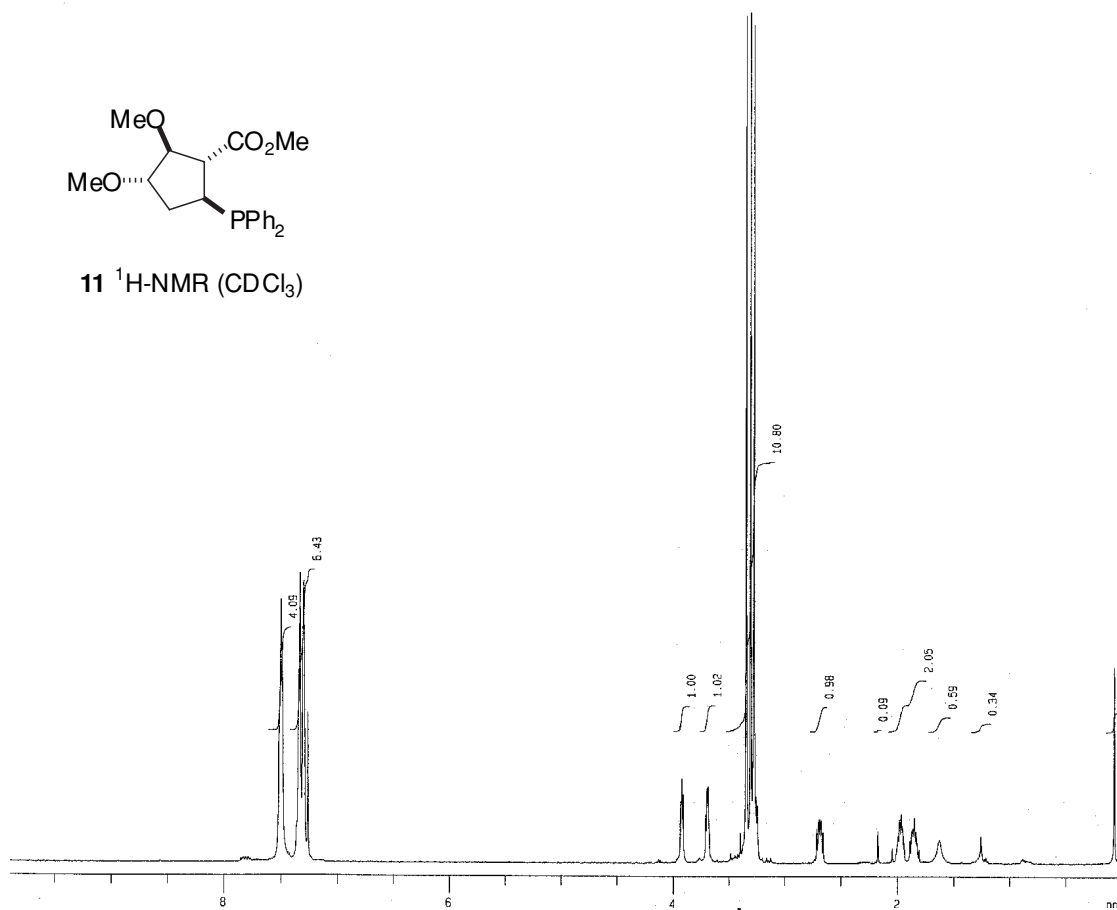




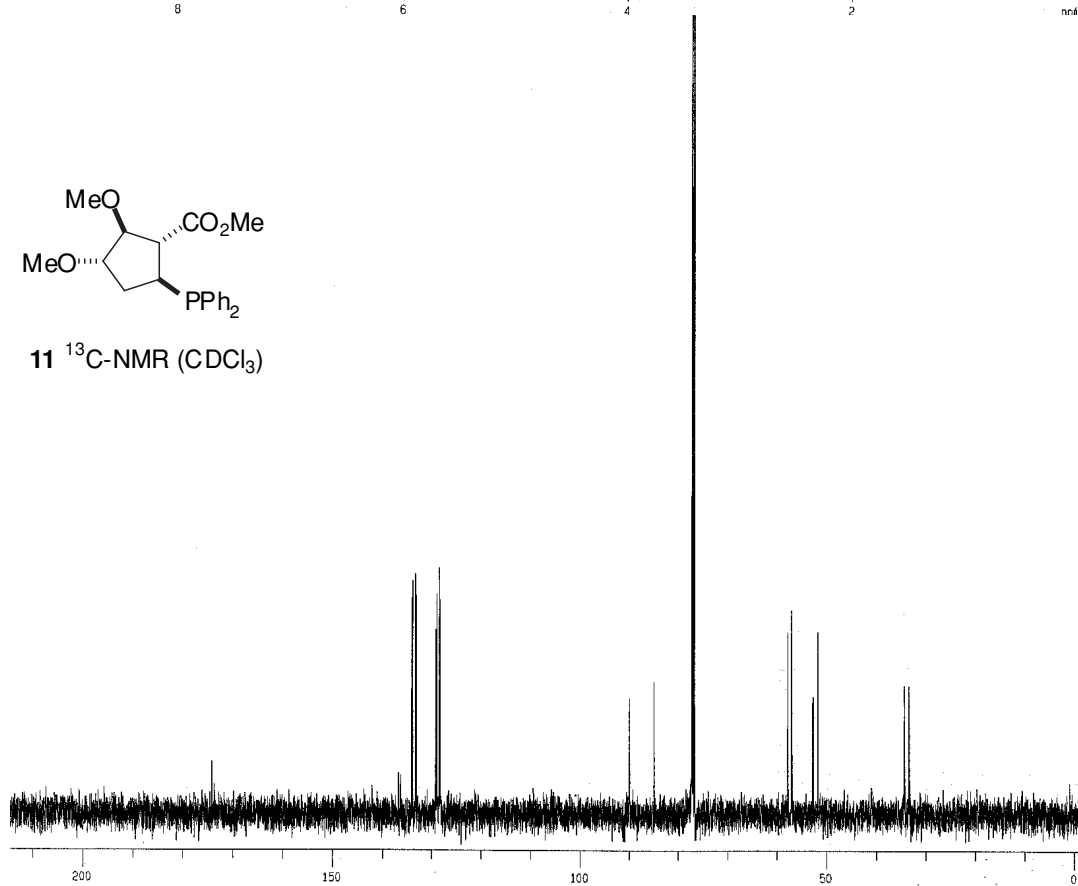


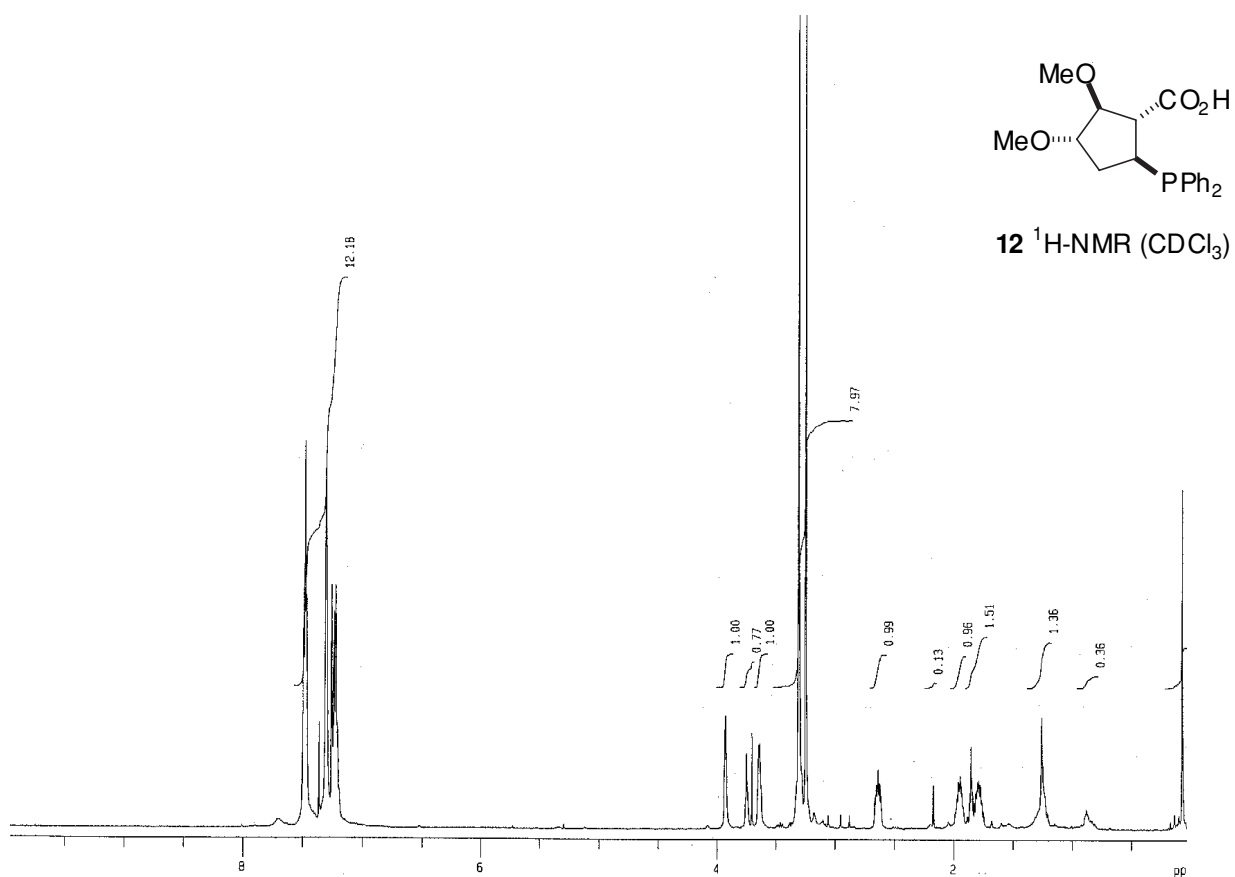
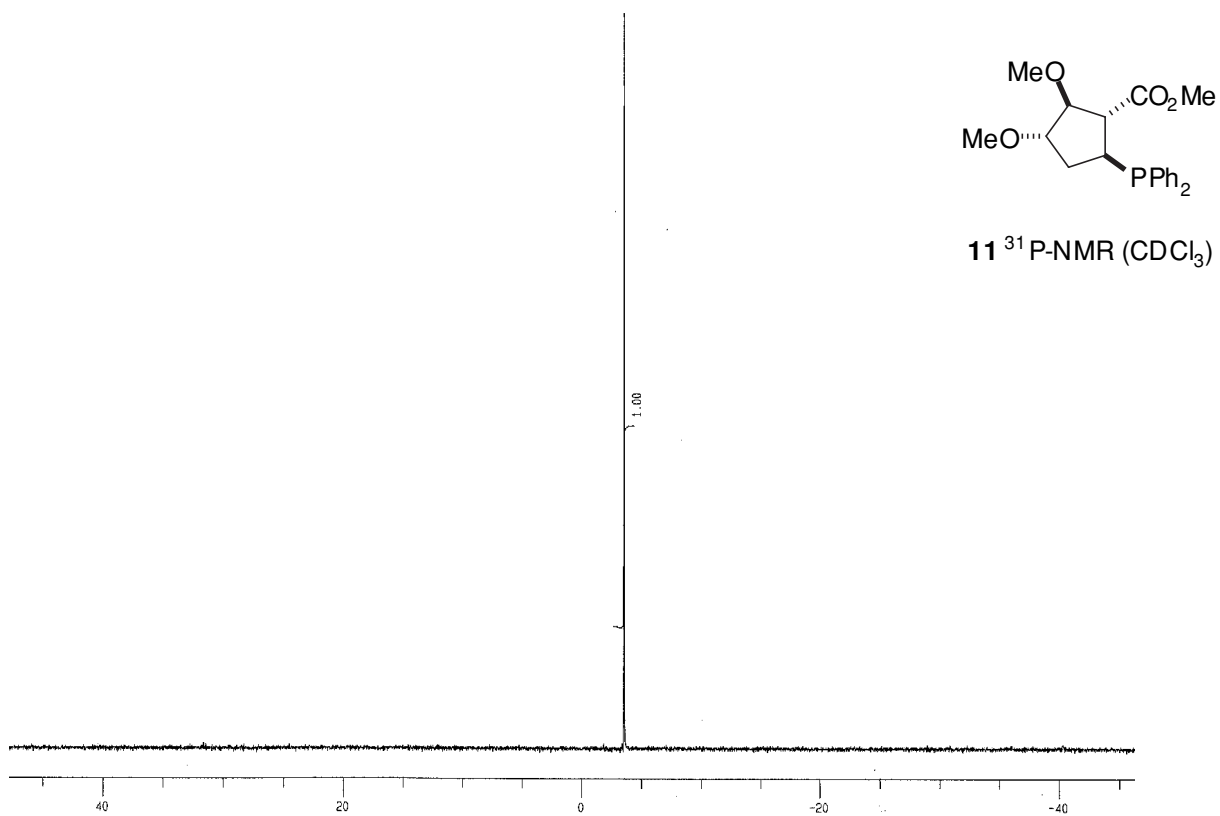


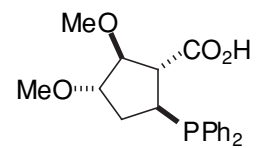
11 ¹H-NMR (CDCl₃)



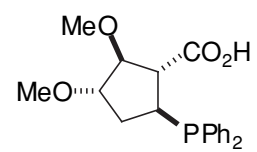
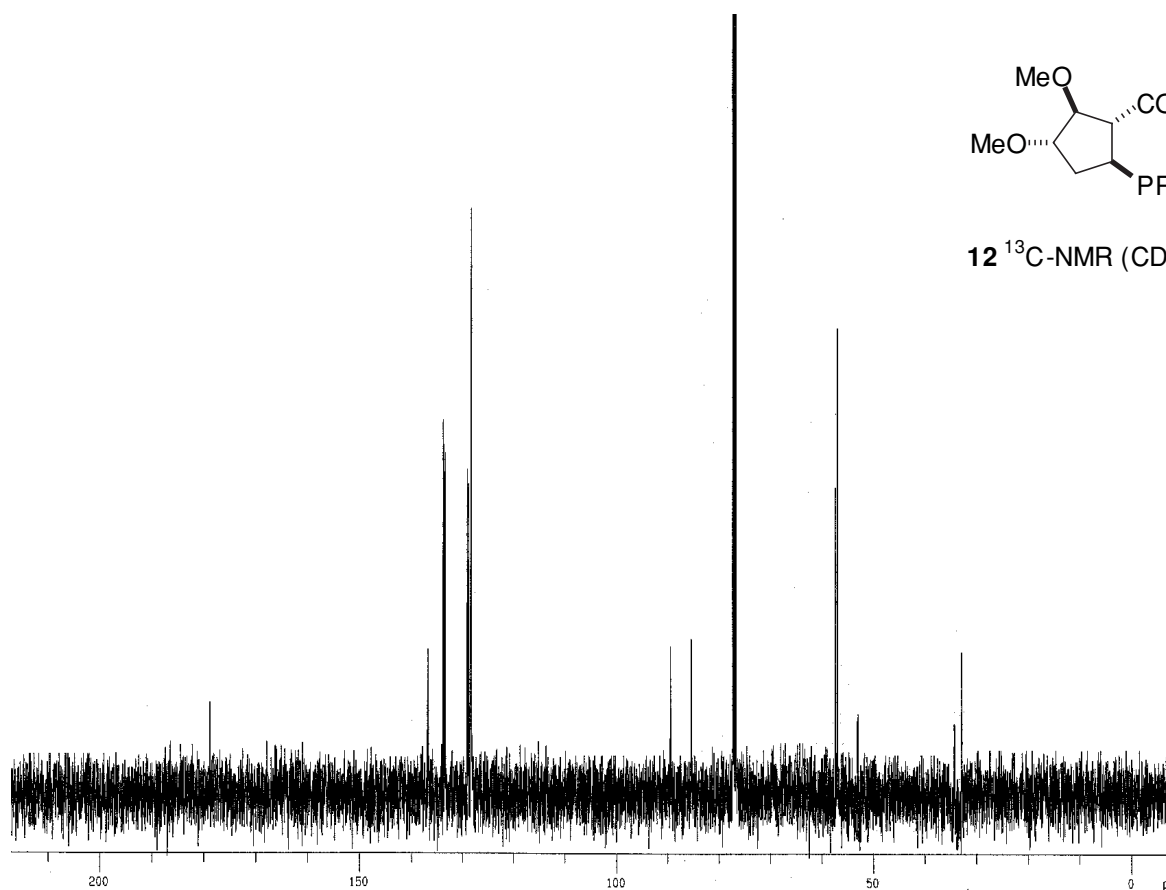
11 ¹³C-NMR (CDCl₃)







12 ¹³C-NMR (CDCl₃)



12 ³¹P-NMR (CDCl₃)

