Regio- & Stereoselective Carbotrifluoromethylthiolation and Carboboration of Alkynes through Organomagnesium Intermediates

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In this dissertation, I have described results of two research projects emphasizing regio- and stereoselective carbofunctionalizations of internal alkynes using Grignard reagents in sequential one-pot protocols. The first involves carbomagnesiation followed by trifluoromethylthiolation of vinyl-magnesium intermediates, affording α-SCF_3 alkenes as single isomers with exclusive *syn*-selectivity. This transformation is noteworthy, as no prior literature demonstrates a combination of α- and *syn*-selectivity, and it is biologically relevant due to the properties of the SCF_3 group. The method proved successful across wide range of substrates and was further extended through diverse derivatizations of the products. Mechanistic and configurational studies, including single-crystal X-ray diffraction and 1D-NOESY, substantiated the findings.

Preliminary difficulties with borylation of sterically hindered vinylmagnesium species (resulting from carbomagnesiation of internal alkynes) led to the development of a new protocol for carboboration of alkynes. This sequence of α-selective *syn*-arylmagnesiation merged with borylation with BpinH efficiently delivers highly substituted alkenyl boronates with unprecedented regioselectivity, which can be converted into configurationally defined tetrasubstituted alkenes. Moreover, other post-functionalizations of these alkenyl boronates further demonstrate the broad applicability and synthetic value of the method. Optimization and DFT played a crucial in elucidating the borylation step.

Additionally, I have validated a proof of concept for project focused on Cu-catalyzed Michael addition with subsequent trifluorometylthiolation proceeding with *anti*-selectivity. This vicinal difunctionalization produces α-SCF_3 ketones, a transformation rarely explored using enones as substrates. Until now, only one example has been reported, however limited to initial addition of ethyl group to the Michael accepting partner. This preliminary finding constitutes a strong foundation for future research aimed at the development of more broadly applicable method.