

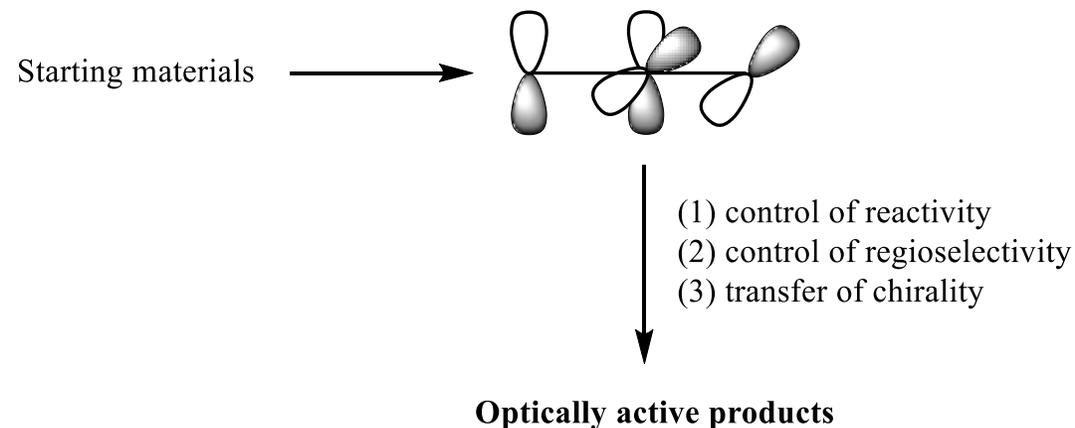
Solvent-Controlled Switching of Cycloisomerization to Transposition in the Ag/Cu-Promoted Reaction of Terminal α -Allenols

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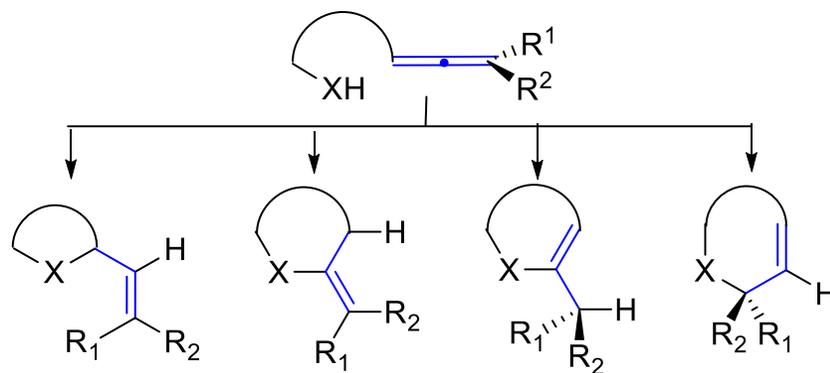
In recent years, chemistry of these compounds has attracted the attention of many chemists giving rise to many studies due to the presence of a cumulated diene in the structure of the compound.

Among most important properties of the allenes include:



(a) Allenes in Organic Synthesis; Schuster, H. F.; Coppola, G. M. *John Wiley & Sons: New York*, **1984**; (b) The Chemistry of Ketenes, Allenes and Related Compounds Part 1; Patai, S. *John Wiley & Sons: New York*, **1980**; (c) Alcaide, B.; Almendros, P. *Chem. Soc. Rev.*, **2014**, *43*, 2883.

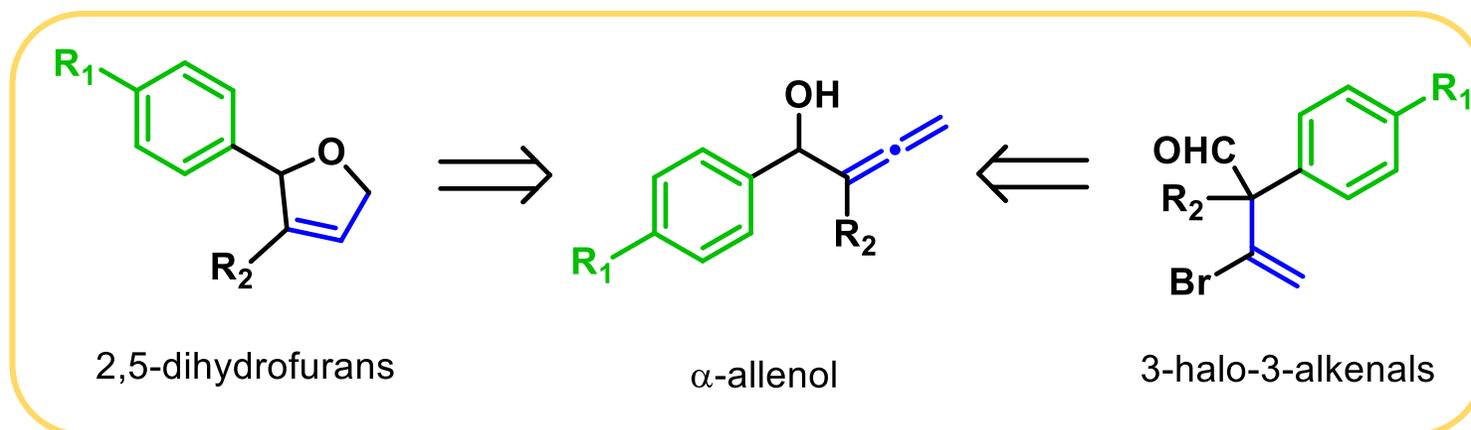
Transition-metal catalyzed nucleophile addition to allene group is a very useful tool for the synthesis of functionalized molecules containing heteroatoms in an atom efficient manner. This reactivity has a benefit because of regiochemistry can be controlled using different metals or changing the substituents or the length of the chain between allene and heteroatom in the intramolecular case.

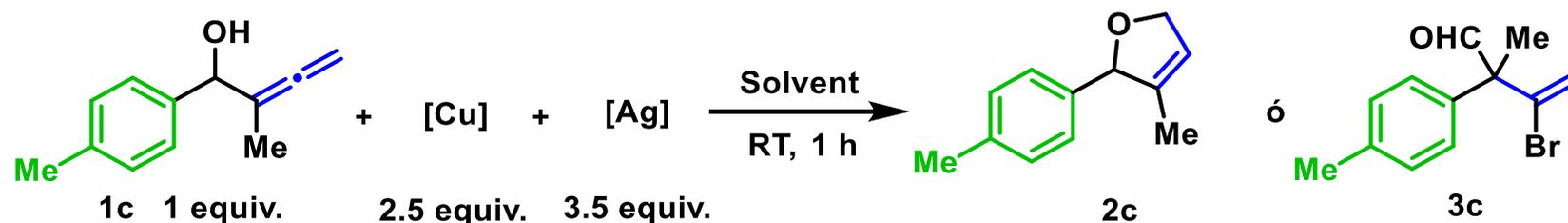


The electrophilic addition of allenes with “X⁺” is very attractive since 2-haloallylic halides or alcohols are usually formed.

(a) Ma, S. *Chem. Rev.* **2005**, *105*, 2829; (b) Krause, N.; Hashmi, A. S. K., Eds. *Modern allene chemistry*, Wiley-VCH: Weinheim, **2004**; (c) Zimmer, R.; Dinesh, C. U.; Nandan, E.; Khan, F. A. *Chem. Rev.* **2000**, *100*, 3067; (d) Krause, N.; Winter, C. *Chem. Rev.* **2011**, *111*, 1994; (e) Muñoz, M. P.; *Chem. Soc. Rev.* **2014**, *43*, 3164; (f) Le Bras, J.; Muzart, J. *Chem. Soc. Rev.* **2014**, *43*, 3003.

Allenes are synthetic precursors useful in Organic Synthesis due to the versatility to carry out different transformations. The main aim of this work is the development of new methodologies for the cyclization and/or transposition of allenols which allow to obtain non-aromatic oxacycles in a regiocontrolled manner, as well as 3-halo-3-alkenals.



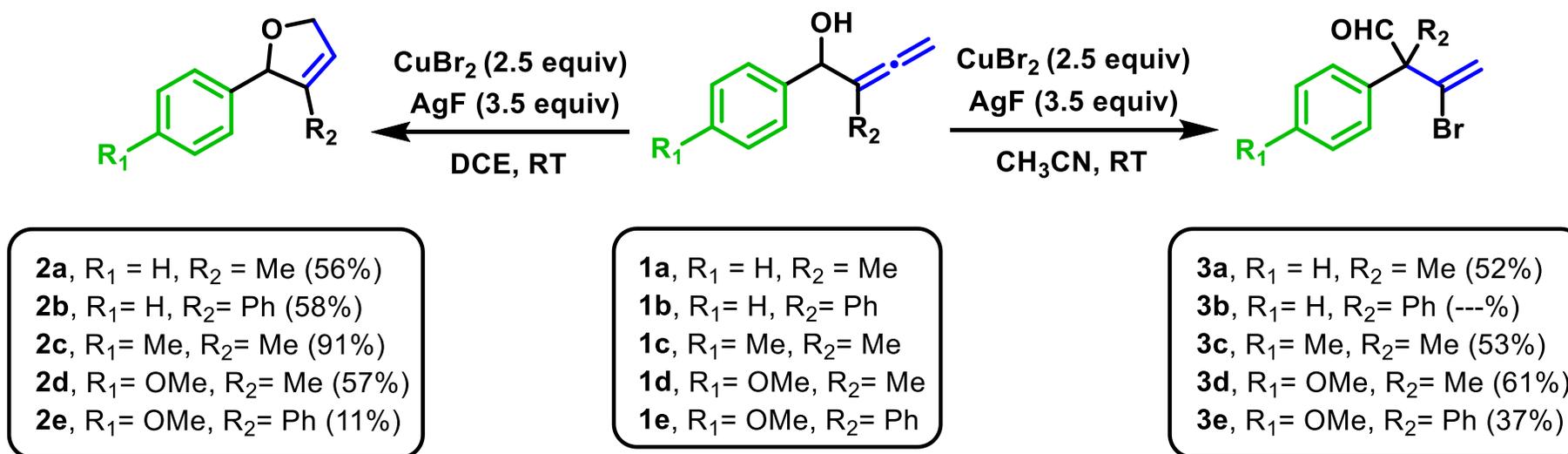


[Cu]	[Ag]	Solvent	Conv. 2:3	Yield (%)
CuBr ₂	Et ₃ N·HF	CH ₃ CN	0:100	45
CuBr ₂	AgF	CH ₃ CN	0:100	73
CuBr ₂	-	CH ₃ CN	0:100	41
-	AgF	CH ₃ CN	100:0	40
CuBr ₂	AgF	DCE	100:0	91
Cu(OAc) ₂	AgF	DCE	100:0	54
CuBr ₂	-	DCE	0:100	38

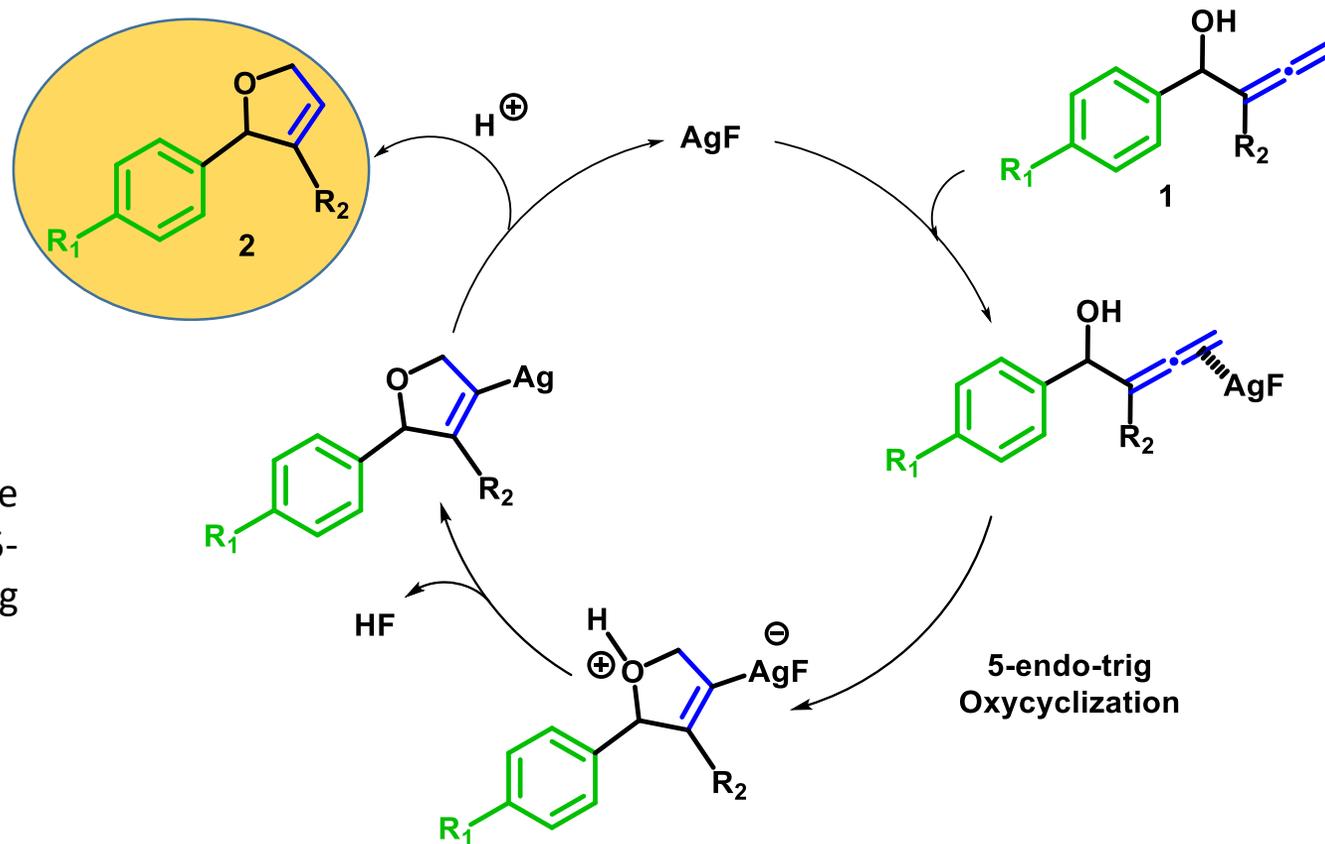
Yellow arrows point from the right side of the table to the rows corresponding to products 2 and 3.

The treatment of allenol **1c** with different Cu (II)- and Ag (I)-based salts in DCE was carried out, which provided the 2,5-dihydrofuran **2c** as the only reaction product resulting from a 5-endo-trig oxycyclization process. However, surprisingly, the treatment of the same α -allenol under the same catalytic conditions, but using CH₃CN as solvent instead DCE provided 3-halo-3-alkenal **3c** as the only reaction product.

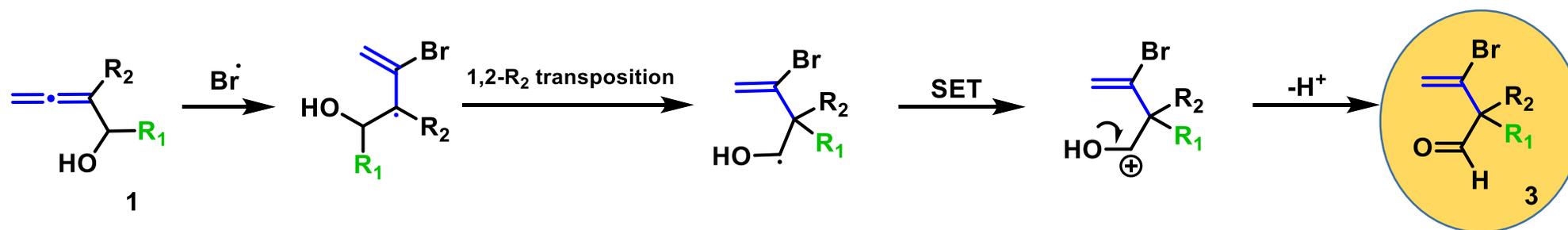
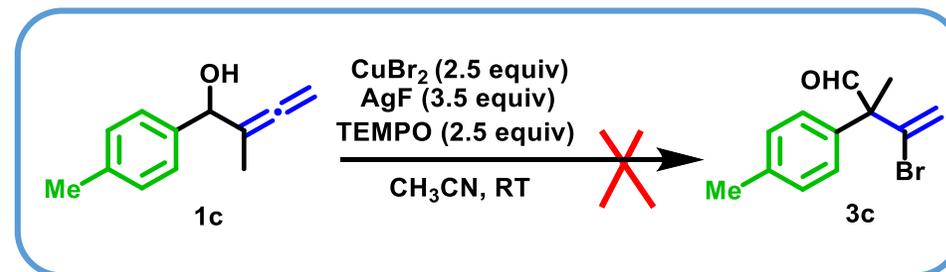
For this reason, the scope of this divergent reactivity was explored using different α -allenols. In the event, both protocols gave rise to 2,5-dihydrofurans **2** and 3-halo-3-alkenals **3**, respectively.

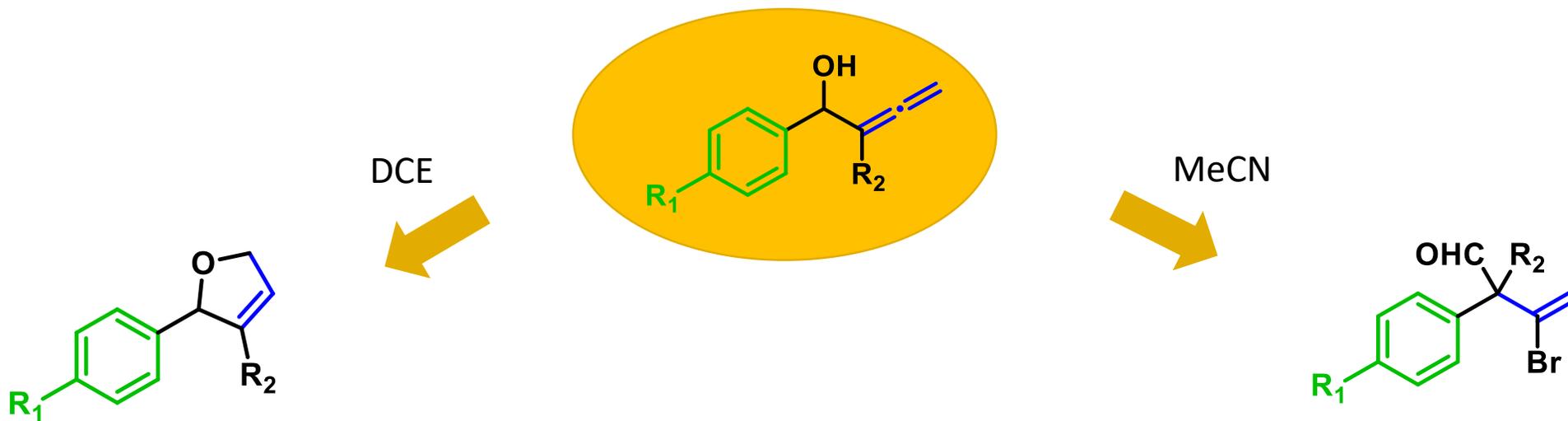


The next scheme describes a putative mechanism for generating 2,5-dihydrofurans **2** from the 5-endo-trig oxycyclization of α -allenols **1**.



It has been proven that the formation of the 3-halo-3-alkenals **3** is a radical process. In this study, the involvement of radicals has been demonstrated through the inhibition of the formation of the corresponding 3-halo-3-alkenal when TEMPO was added to the reaction medium.





In this project, we have investigated new methodologies for obtaining 2,5-dihydrofurans as well as 3-halo-3-alkenals starting from α -allenols with a bimetallic system Ag/Cu.

Surprisingly we found that, for the same reaction conditions, when changing the solvent, the product obtained changed.

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