Gold catalyzed synthesis of tetrahydrocarbazole derivatives through an intermolecular cycloaddition of vinyl indoles and *N*-allenamides

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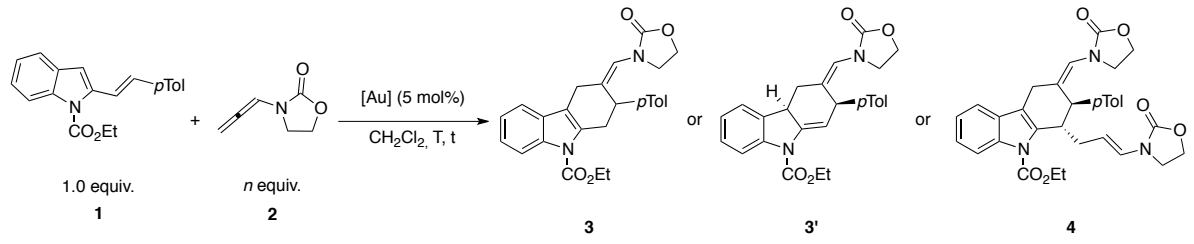
In the last decades intramolecular gold-catalyzed transformations have been broadly studied giving access to a series of relevant scaffolds. Among unsaturated substrates allenes offered a complete versatility participating in [2+2], [4+2] and [4+3] cyclizations. In contrast, the development of an intermolecular version of these transformations remains less explored. In this context significant [2+2] and [4+2] cycloadditions have been recently reported,[1] including examples of enantioselective versions.[2]

Due to our interest in the preparation of functionalized carbazoles derivatives[4] and considering the recent employment of *N*-allenamides in intermolecular cycloaddition reactions,[1,2] we decided to study the viability of gold-catalyzed cycloaddition between allenes and vinyl indoles, which might offer a simple and selective access to these relevant structures.

Thus, it was found that an appropriate choice of the substituent at *N*-1 of the indole and of reaction conditions enabled the selective preparation of isomeric tetrahydrocarbazoles **3, 3'** and of unexpected compound **4**, arose from an unusual multicomponent cascade sequence.



With optimized reaction conditions in hand, it was possible to evaluate the scope of these transformations varying both the vinyl indole and the *N*-allenamide moieties. A mechanism for the formation of the products through a formal [4+2] cycloaddition reaction has been proposed and supported by experimental evidences.

1. For a review on gold-catalyzed cycloadditions see: J. L. Mascareñas et al., *Belstein J. Org. Chem.* **2011**, *7*, 1075.
2. a) J. L. Mascareñas et al., *J. Am. Chem. Soc.* **2012,** *134,* 14322; b) J. M. González et al., *Angew. Chem. Int. Ed.* **2012,** *51,* 11552.
3. a) E. Rossi et al., *Eur. J. Org. Chem.* **2007,** 517; b) E. Rossi et al., *Synlett* **2012,** 2913.