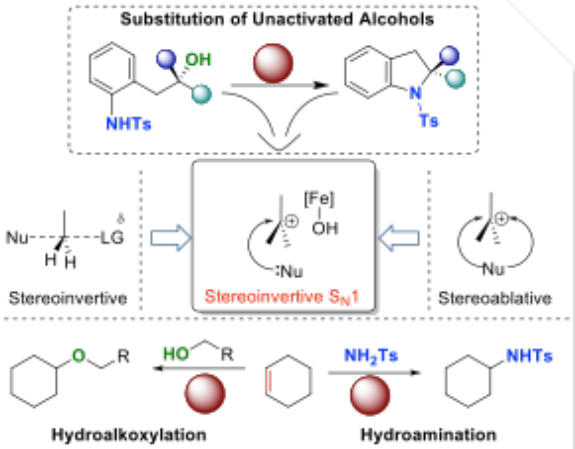
QCB Evenings

Monday, November 5th • 5:30-7:00pm • Chemistry C033

Stereoinversion of unactivated alcohols by tethered sulfonamides and the hydrofunctionalization of unactivated alkene

❖ **Paul Marcyk, Cook Lab**

Direct, *catalytic activation* of alcohols for substitution is an attractive, atom-economical approach to form carbon-heteroatom bonds. We have found that the combination of $FeCl_3$ with $AgSbF_6$ is a powerful Lewis acid catalyst capable of activating secondary and tertiary aliphatic alcohols for substitution with sulfonamide nucleophiles. Furthermore, by employing the concept of tight-ion pairing as a solution to cation facial selectivity, an intramolecular variant of the reaction proceeds enantiospecifically, transferring the chiral information from secondary and *even tertiary* alcohols, forming enantioenriched 2-substituted pyrrolidine and indoline rings. Similar reactivity is observed when unactivated alkenes are used as the electrophile. Using a wide variety of sulfonamides or alcohols, the hydroamination or hydroalkoxylation product is obtained. Both methods allow for the efficient formation of carbon heteroatom bonds from abundant starting materials.



Modular interior loading and exterior decoration of a virus-like particle

❖ **Jhanvi Sharma, Douglas lab**

Virus-like particles (VLPs) derived from the bacteriophage P22 offer an interesting and malleable platform for encapsulation and multivalent presentation of cargo molecules. The packaging of cargo in P22 VLP is typically achieved through genetically enabled directed *in vivo* encapsulation. However, this approach does not allow control over the packing density and stoichiometry of the encapsulated cargos. We have demonstrated that an *in vitro* assembly approach can be utilized to gain control over cargo packaging in P22.[1] The packaging was controlled by closely regulating the stoichiometric ratio of cargo-fused-scaffold protein and wild-type scaffold protein during the *in vitro* assembly. In a "one-pot assembly reaction" coat protein subunits were incubated with varied ratios of wild-type scaffold protein and cargo-fused-scaffold protein, which resulted in the encapsulation of both components in the co-assembled capsid. These experiments demonstrate that the input stoichiometry can be used to achieve controlled packaging of multiple cargos within the VLP. The porous nature of P22 allows the escape and re-entry of wild-type scaffold protein from the assembled capsid but scaffold protein fused to a protein-cargo cannot traverse the capsid shell due to the size of the cargo. This has allowed us to control and alter the packing density by selectively releasing wild–type scaffold protein from the co-assembled capsids. We have demonstrated these concepts in the P22 system using an encapsulated streptavidin protein and have shown its highly selective interaction with biotin or biotin derivatives. Advancing further, we have utilized these concepts to control the loading and packing density of enzymatic cargo molecules within P22.

Encapsulation of enzymes inside nanocages provides a unique platform to construct catalytically functional nanomaterials; however, it often results in alteration of kinetic parameters in comparison with free enzymes. We believe that this study will help us to understand the effect of molecular crowding on kinetic parameters of encapsulated enzyme molecules.

1. Sharma, J.; Uchida, M.; Miettinen, H.M. *Nanoscale,* **2017**, 9, 10420-10430.

All students and post-docs welcome! Pizza and Beverages will be provided