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Chiral Amplification in Molecular and Supramolecular Frameworks

Friday, October 3rd at 3:00 in 320 Havemeyer
hosted by Professor Koji Nakanishi

Systems non-superimposable with their mirror images are set to be chiral and exist in two enantiomeric forms. When chiral molecules interact with an achiral entity, the two opposite enantiomers are indistinguishable. However, as in the famous case of thalidomide, they may respond differently when interacting with another chiral entity. Light can also be chiral, as circularly polarized light (CPL) is, and the different response of a chiral system when interacting with opposite CPLs gives rise to chiroptical spectroscopies i.e. circular dichroism (CD) and optical rotatory dispersion (ORD).

The response of these spectroscopies to the particular geometry of a system enables absolute configuration and conformational determination. Additionally, chiroptical responses may be sensitive to intermolecular interactions. In this respect, access to systems with strong chiroptical responses is desired in order to allow their use in sensing applications. We have been working on the design and synthesis of open, cyclic, and cage-shaped chiral oligomers showing remarkable chiroptical amplification compared to the monomer by an appropriate combination of functionalized spacers and chiral axis. On the other hand, adsorption of achiral nanoparticles onto fibers with helical topography gave outstanding CD responses. More recently, we constructed up-standing chiral architectures by morphological self-assembly of enantiopure allenes. Careful analysis of high-resolution STM images confirms the transfer of chirality from single molecules to overall chiral 2D networks. The use of enantiopure allenes with strong chiroptical responses is promising for the construction of new materials.