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Fighting Fire with Fire: Racemization drives Deracemization

Life has chosen a single handedness, which manifests itself in D-sugars and L-amino acids, through the long and complex pathway of biological evolution. Probably, without that stereochemical constraint, crucial processes such as selective replication and transcription would have been difficult, if not impossible, to achieve. The origin of homochirality in nature has puzzled and mesmerized scientists from Pasteur's times. Every theory and finding since shed light into the mystery. From a practical viewpoint, the ability of enzymes to selectively recognize chiral forms leads to the key consequence that, very often only one enantiomer (eutomer) of a chiral drug triggers the therapeutic effect, while the other (distomer) is no more than ballast to the biological action and may even be detrimental. Switch from racemates to unichiral compounds has become an imperative to the pharmaceutical industry in the search for more potent and selective drugs.

The way to chiral purity has traditionally viewed racemization as the biggest enemy to beat. A plethora of talented synthetic chemists have invented elegant asymmetric methodologies aided by enantiopure reagents and catalysts to overcome the undesirable isomer. In fact, the late William Bonner wrote, in one of the first reviews dealing with the origin of homochirality (1991): "all mechanisms for the origin and amplification of molecular chirality have racemization as their ultimate nemesis ...". Nearly two decades later (2007), we concluded however that "the molecular racemization in solution can be considered the driving force that guarantees chiral purity ...". What happened in between to move racemization from foe to friend?

This talk will summarize the experiments, hypothesis, results, and of course a touch of serendipity, which led us to exploiting racemization as the driving force for homochirality. Under certain conditions, one enantiomer nurtures the other in an autocatalytic fashion that evolves into single handedness.

Thursday 29 November 2018 at *4.30 P.M.*

COFFEE AND TEA WILL BE SERVED AT 4.10 P.M. IN FRONT OF THE SOLVAY ROOM

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