Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Seminar

Tales in Molecular Evolution: From Chiral Symmetry Breaking to New-to-Nature Biocatalysis

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The evolutionary journey of chemistry on our planet, from small molecules to genetic polymers, presents fascinating opportunities for the organic chemist. At one end, mysterious early steps evoke grand questions at the foundations of chemistry, while at the other, biology's extraordinary machinery lies primed for creative manipulation.

An illustration of the former is the riddle of the origin of biological homochirality, inspiring the general query, 'can asymmetric synthesis transpire without any chiral intervention'? The Soai reaction – diisopropylzinc alkylation of pyrimidine carbaldehydes – remains a singular, celebrated example where this is possible and has received widespread attention from diverse chemical fields. I will present structural, experimental, and computational investigations which reveal the first comprehensive mechanistic picture of this iconic transformation.

For the latter case, I will showcase how the principles of directed evolution can be applied to develop new enzymes for promoting processes never seen in nature. The engineering of heme proteins enables enantioselective catalysis of challenging nitrene C–H insertion reactions for accessing nitrogen containing compounds from feedstock chemicals. This example of 'new-to-nature biocatalysis' is emblematic of a modern age of protein biochemistry that promises to revolutionize the use of enzymes for molecular construction.

Tuesday, Dec 27th 2022

4:00 PM (Tea/Coffee at 3:45 PM)

Auditorium, TIFR-H