SYNPHOCAT - Synthetic Bimodal Photoredox Catalysis: Unlocking New Sustainable Light-Driven Reactivity

Solar light is an inexhaustible and free reactant that can promote the construction and transformation of molecules. The chemistry community is particularly interested in photocatalysis, which uses light to promote a chemical transformation. Photocatalysts (PCs) play a key role in transformative light-driven processes. The selection and structural refinement of PCs can channel reactivity to diverse mechanistic pathways, but often proceeds via trial and error. Here, I will use structure-property relationships to: 1) define novel bimodal organic PCs able to catalyse thermodynamically demanding and opposite photoredox events exploiting their electronically excited state; 2) explore the PCs' reactivity by means of their radical ions, going beyond conventional photoredox approaches; 3) capitalise on the new reactivity and bimodal way of action of the PCs to implement novel selective transformations of biological targets under physiological conditions. These project core concepts will be accomplished by the rational evaluation and optimisation of the PCs physicochemical and structural properties as well as the careful analysis of the mechanistic features subtending the light-driven chemical events. Overall, SYNPHOCAT will deliver new conceptual and experimental tools for the sustainable light-driven construction and functionalisation of biorelevant molecules, opening the way to a new dimension of sustainable light-driven chemistry.

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