

Photomodulated Enzyme Cofactor Mimic based on Pyridoxal 5'-Phosphate

Danielle Wilson and Neil R. Branda*, Simon Fraser University, Department of Chemistry, 8888 University Drive, Burnaby, British Columbia, V5A 1S6

Modulation of enzyme activity with light is an appealing method for gaining external control over biological processes as it is convenient, non-invasive and offers precise spatial and temporal resolution. This is commonly achieved by incorporating a photoactive unit directly into the biomolecule of interest. A new approach is to create a photoswitchable enzyme cofactor, which is advantageous since cofactors are often smaller, simpler, easier to tune than their enzyme counterparts and are often involved in more than one enzymatic process. We describe the development of a photoswitchable Pyridoxal Phosphate (PLP) mimic. PLP is a common cofactor found in most organisms, essential for amino acid metabolism. By integrating a photoresponsive dithienylethene into the backbone of PLP, this allows it to be reversibly interconverted between two different isomers, each with a unique set of properties using UV or visible light. The active isomer, generated with UV light, maintains the necessary electronic communication required for substrate conversion. When irradiated with visible light, the inactive isomer is generated, disrupting communication and interrupting function. We show that our enzyme cofactor mimic can act as an on/off switch to gate racemization of amino acids.