Poster Presentation

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Shikimate kinase-like 1 plays an integral role in chloroplast biogenesis

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The shikimate pathway is found in plants, fungi, and microbes, but not mammals which makes it an attractive target for antimicrobials and herbicide development. In plants, the shikimate pathway produces precursors of compounds that are crucial for growth, defense and, survival. We focused on the enzyme shikimate kinase (SK) which catalyzes the phosphorylation of shikimate; the fifth reaction of the pathway. Plant SK underwent a gene duplication event yielding shikimate kinase-like genes (SKL1 and SKL2) roughly 400 MYA. Despite the overall similarity in sequence between SK and SKL1, a previous in vitro analysis showed that SKL1 does not catalyze a phosphorylation reaction in the presence of shikimate. When a three-dimensional structural model of SKL1 was compared with the microbial crystal structure of SK, we identified several highly conserved functional domains crucial for the shikimate kinase reaction: the shikimate binding domain (SBD) critical for substrate recognition, the LID domain integral for the transfer of phosphate to bound shikimate, and the walker A and B domains important for ATP binding. Of these domains, only the walker A and B domains are conserved in SKL1. Together with in vitro analysis, it is evident that SKL1 does not interact with shikimate, but the function is still unknown. Sequence alignment and modeled structure also revealed the presence of a novel phosphoglycerate mutase-like (PGML) domain within SKL1.This further suggests neofunctionalization of SKL1 compared to its parent gene SK. Current studies in our lab focus on determining the crystal structure of SKL1. This structure will be used for ligand docking experiments to identify potential substrates of the enzyme. As an additional means of substrate identification, we will also be performing crystal soaking experiments using plant extracts.

Keywords: Shikimate Kinase, Plant