Probing Selectivity in Sugar Transport Proteins

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Sugar distribution plays essential roles in energy, signaling, and defense mechanisms. Sugar Transport Proteins (STPs) are part of the Sugar Porter family that also include human GLUTs. In plants, STPs are responsible for proton-driven cellular uptake of glucose, derived from sucrose in the apoplast. Few STPs also facilitate uptake of fructose, the other constituent of sucrose but the molecular features that define differences in specificity are unknown.

Here I present our work on elucidating substrate specificity in STPs, including new structural data of Arabidopsis thaliana STP6. We show that it is both a glucose and fructose transporter and perform a comparative analysis between STP6 and the glucose-specific STP10 using in-vivo and in-vitro based systems. We show how kinetic transport properties are influenced by the experimental setup and give insights into the fine-tuned dynamics of affinity-induced specificity for hexose uptake, ultimately showing how the position of a single methyl group in the binding site is sufficient to determine substrate specificity. These findings advance the understanding of hexose trafficking by Sugar Porters and extend the framework for engineering specific hexose transport.