Auxin biosynthesis inhibitors, new tools for auxin study and regulation

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Auxin is essential for plant growth and development, which makes it difficult to study the biological function using auxin-deficient mutants. Chemical genetics have potential to overcome this difficulty by transiently reducing the auxin action using inhibitors. In *Arabidopsis thaliana*, the indole-3-pyruvate (IPyA) pathway has been suggested as a major biosynthesis pathway of indole-3-acetic acid (IAA), the most common natural auxin. In this pathway, TRYPTOPHAN AMINOTRANSFERASE of ARABIDOPSIS1 (TAA1) catalyzes the first step of conversion from tryptophan (Trp) to IPyA, and then YUCCA, a flavin-containing monooxygenase, catalyzes the last step from IPyA to IAA. We developed several types of auxin biosynthesis inhibitors. The first group of compounds, targets TAA1, and contains aminooxy- and carboxy- groups. These compounds consist of novel compounds, designated 'Pyruvamine (PVM)'. The second group of compounds targets YUCCA, and contains borate structure. These compounds inhibited the activity of recombinant enzymes *in vitro*, and reduced endogenous IAA content *in vivo*. Arabidopsis seedlings treated with inhibitors showed typical auxin deficient phenotypes and the growth inhibition was recovered in the presence of exogenous IAA. Enzyme kinetic studies of compounds revealed that they are competitive inhibitors of the substrate Trp or IPyA. Structure-activity relationships of the compounds will be discussed. These small molecules will serve as novel and powerful tools in chemical genetics for study of auxin biology and regulation of auxin biosynthesis.

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