

Altering Expression of Cinnamic Acid 4-Hydroxylase in Transgenic Plants Provides Evidence for a Feedback Loop at the Entry Point into the Phenylpropanoid Pathway¹

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Pharmacological evidence implicates trans-cinnamic acid as a feedback modulator of the expression and enzymatic activity of the first enzyme in the phenylpropanoid pathway, L-phenylalanine ammonia-lyase (PAL). To test this hypothesis independently of methods that utilize potentially non-specific inhibitors, we generated transgenic tobacco lines with altered activity levels of the second enzyme of the pathway, cinnamic acid 4-hydroxylase (C4H), by sense or antisense expression of an alfalfa C4H cDNA. PAL activity and levels of phenylpropanoid compounds were reduced in leaves and stems of plants in which C4H activity had been genetically down-regulated. However, C4H activity was not reduced in plants in which PAL activity had been down-regulated by gene silencing. In crosses between a tobacco line over-expressing PAL from a bean PAL transgene and a C4H antisense line, progeny populations harboring both the bean PAL sense and C4H antisense transgenes had significantly lower extractable PAL activity than progeny populations harboring the PAL transgene alone. Our data provide genetic evidence for a feedback loop at the entry point into the phenylpropanoid pathway that had previously been inferred from potentially artifactual pharmacological experiments.