

Metabolism and Metabolomics of the Plant Surface

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The cuticular layer plays multiple roles in plants including the regulation of epidermal permeability and the protection against insects and UV light. It also functions in development as for example in the prevention of post-genital organ fusion and pollen-pistil interactions. Generation of cuticular components in epidermal cells involves 2 major biosynthetic pathways, namely, the synthesis of cutin monomers and aliphatic wax components.

In recent years we dissected several aspects of the cuticle assembly including those related to transport, cutin polymerization and the transcriptional regulation of metabolic pathways. Members of a small clade of ABC-type transporter genes have been characterized that are involved in the transport of components from the epidermis through the plasma membrane to the cuticle construction site. The data provided evidence that these proteins function in the transport of wax and/or cutin constituents and possibly suberin (chemically similar to the cutin polymer). We showed that a member of the BAHD family of acyltransferases (termed DCR) is required for incorporation of the most abundant monomer into the polymeric structure of the Arabidopsis flower cutin. In terms of transcriptional regulation, we are conducting in-depth characterization of the SHINE (SHN)/WAX INDUCER (WIN) clade of transcription factors that control the cutin biosynthesis pathway. Arabidopsis plants silenced for all three SHINE genes were examined for alterations to gene expression using microarrays and two dozen putative target genes were identified.

Taken together, this work provides insight to the molecular and metabolic basis for cuticle assembly in both vegetative and reproductive plant organs.