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New Insights into Anthocyanin Biosynthesis

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PURPOSE OF THE ABSTRACT

Anthocyanins are ubiquitous plant pigments, which participate in the attraction of pollinators and seed dispersers as well as in stress response. The food, nutraceutical, and cosmetic industries increasingly adopt the use of these bioactive molecules due to their diverse color palette and their many proposed health benefits. To produce the pigments on a large scale, plant raw materials with high levels of stable anthocyanins are typically extracted, despite the associated issues of sustainability and supply.

With over a century of research focused on the biochemistry and regulation of the natural colorants' biosynthesis, the route toward anthocyanins is often considered the best understood plant secondary metabolic pathway. Nevertheless, construction of microbial cell factories to produce anthocyanins with commercially viable product titers has not yet been achieved due to issues arising from the late steps of the biosynthetic pathway. In our study, we focus on the penultimate biosynthetic step to the colored anthocyanidins which is thought to be catalyzed by leucoanthocyanidin dioxygenase. However, this reaction has never been fully reconstituted in vitro or in heterologous microorganisms. Based on biochemical, structural, and computational evidence, we present new insights into key enzymatic transformations. Based on this knowledge, we succeeded to incorporate a heterologous pathway into baker's years leading to greatly increased anthocyanin production. Our elucidation of the long-elusive late biosynthesis of anthocyanins paves the way for the construction of microbial production platforms for these relevant natural colorants and will impact the breeding of industrial and ornamental plants.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

anthocyanin biosynthesis | enzyme mechanism | yeast engineering | protein structure

BIBLIOGRAPHY