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Discovery and engineering of terpenoid metabolism in medicinal plants and food crops: From chemical diversity to biotechnology applications

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Terpenoids are the largest and most diverse metabolite class in plants with essential functions in plant development and ecological interactions. Their various bioactivities offer a rich source for novel pharmaceuticals and other bioproducts, as well as offers new leads for enhancing stress resistance in crop plants. However, a broader industrial application of plant-derived terpenoids remains limited by the narrow taxonomic distribution, low abundance and complex diversity of these metabolites in nature. We established deep transcriptome resources for more than a dozen non-model medicinal plants and food crops which produce terpenoid metabolites of economic importance. We established an efficient gene discovery platform, combining metabolite profiling with generation and gene-specific analysis of these transcriptome inventories that resulted in the discovery of more than 60 terpene synthases and several hundred cytochrome P450-dependent monooxygenases, as key enzymes in generating terpenoid metabolic diversity. Functional enzyme characterization revealed numerous novel terpene synthase functions as part of dynamic modular pathways, where catalytically distinct enzymes may function in different combinations to enhance chemical diversity. Following nature's lead, we developed proof-of-concept yeast expression platforms for several diterpenoids through combinatorial expression of functionally distinct terpenoid pathway genes.

Biography

Philipp Zerbe is an Assistant Professor at the Department of Plant Biology, University of California at Davis. His research focuses on the discovery and engineering of specialized terpenoid metabolism in medicinal plants and food crops for developing tools for the production of terpenoid bioproducts with human benefit. For his research, he recently received the Arthur C. Neish Young Investigator Award. Prior to his position at UC Davis, he received his PhD from the Ruhr-University Bochum, Germany (2007), followed by positions as a Post-doctoral Fellow and Research Associate at the University of British Columbia (Vancouver, Canada).

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