DANIÈLE WERCK-REICHHART

Biography:

Danièle Werck is an expert on cytochrome P450 enzymes and on their roles in plant metabolism (bioynthesis of biopolymers, biosynthesis of aromatic terpenoids and of molecules with therapeutic applications, metabolism of herbicides) she became a major actor in these fields.

She is Group Leader of CYTOCHROMES P450 AND ASSOCIATED METABOLIC PATHWAYS at the Institute for Plant Molecular Biology at The National Center for Scientific Research in France.

After an initial training in Biochemistry and Molecular Biology, Danièle Werck obtained her PhD in 1978. An industrial postdoc on herbicides metabolism, was followed by a recruitment by CNRS in 1980. She had two sabbaticals, one at University of Bristol in the laboratory of the Professor O.T.G. Jones working on heme biosynthesis in 1985, and a second at the Carnegie Institute of Stanford in the laboratory of the Professor Chris Somerville for an initiation to Arabidopsis genomics in 1999. Since 2005, Danièle Werck has been CNRS Research Director, heading the 'Plant Cytochromes P450' group and the department 'Plant Metabolic Networks' at the Institute of Plant Molecular Biology of CNRS.

Link: http://www.ibmp.cnrs.fr/equipes/cytochromes-p450-et-metabolismes-associes/

VILLUM Plant Plasticity Seminar:
A strategy of flower defense: combinatorial promiscuity to form a legion of metabolites
Danièle Werck

Flowers are essential but vulnerable organs of the plant, exposed to pollinators and florivores, but flower chemical defenses were rarely investigated. A terpene synthase (TPS11) and a cytochrome P450 (CYP706A3) genes are clustered on chromosome 5 of Arabidopsis thaliana. They are tightly co-expressed in floral tissues, upon anthesis, but also all along in floral bud development. TPS11 was previously shown to generate a blend of sesquiterpenes, with (+)-α-barbatene and (+)-thujopsene as major components. By co-expression of TPS11 and CYP706A3 in yeast and Nicotiana benthamiana, we demonstrate that CYP706A3 not only metabolizes the TPS11 products, but also further oxidizes its own primary oxidation products. Analysis of the headspace and soluble metabolites of CYP706A3 insertion and overexpression mutants indicates that CYP706A3-mediated metabolism largely suppresses not only sesquiterpene, but also monoterpene emission from open flowers and generates terpene oxides retained in floral tissues. CYP706A3-dependent oxidation of flower-expressed TPS21 and TPS24 products is confirmed in vitro. In flower buds, the concerted expression of TPS11 and CYP706A3 essentially generates soluble sesquiterpene oxides, not allowing any volatile emission. Homology modeling supports and explains CYP706A3 promiscuity observed in vivo and upon in vitro assays. Florivory assays performed with the Brassicaceae specialist Plutella xylostella demonstrate that insect larveae avoid feeding on bud expressing CYP706A3 and accumulating terpene oxides. We show, in addition, that expression of CYP706A3 alters the composition of the floral microbiome. Phylogenomic analysis tells that TPS11 and CYP706A3 co-evolved with Brassicaeae to form the smallest and most versatile functional gene cluster ever described in plants.