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#### TITLE

“Evolution of chemical diversity in glandular trichomes – from seed ferns of the Late Carboniferous to present day cannabis”

#### PRESENTER, AFFILIATION

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#### ABSTRACT

The ability to sequester secondary (or specialized) metabolites and defense proteins in secretory structures was a critical adaptation that has shaped plant-herbivore and plant-pathogen interactions for hundreds of millions of years. Secretory structures in terrestrial plants appear to have first emerged as intracellular oil bodies in liverworts. In vascular plants, internal secretory structures, such as resin ducts and laticifers, are usually found in conjunction with vascular bundles, while subepidermal secretory cavities and epidermal glandular trichomes generally have more complex tissue distribution patterns. An overview of the evolution of these secretory structures - and the chemical diversity found within them - will be provided. Recent breakthroughs in our understanding of the chemistry, biochemistry and molecular genetics of specialized metabolism have enabled the development of mathematical models, which have begun to shed light onto the unique flux distribution at the interface of central carbon metabolism and pathways that lead to the accumulation of exceptionally high concentrations of certain metabolites. Examples of how iterative cycles of modeling and experimentation have been employed to characterize processes relevant to the unique metabolism in secretory structures and specialized cell types will be presented.

#### SHORT BIO

Bernd Markus (“Mark”) Lange was trained as a chemist with B.Sc. and M.Sc. degrees from the University of Bonn in Germany. He obtained his Ph.D. in 1995 from the University of Munich. Following postdoctoral studies at the University of Tübingen and Washington State University, Mark spent four years in the biotechnology industry as a group leader for Novartis, Syngenta and Diversa. In 2004, he transitioned back into an academic position and rose through the ranks at Washington State University, where he is currently a professor at the Institute of Biological Chemistry and also directs the M.J. Murdock Metabolomics Laboratory. Mark’s

academic research program is focused on unraveling the biochemical pathways leading to bioactive natural products, in particular those that are synthesized and accumulated in specialized cell types such as glandular trichomes, resin ducts and laticifers. Pathways of particular interest are those leading to monoterpenes in mint, to the anti-cancer diterpene taxol in the genus *Taxus*, to flavonoids or alkaloids in early land plants, and cannabinoids and terpenoids in cannabis. Studies on enzyme structure-function relationships are focused on terpene synthases and functionalization enzymes in the mint family.