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Reconstructing the interaction network of reproductive homeotic proteins in a gymnosperm

In angiosperms (flowering plants), flower development is controlled by hierarchically organized networks of genes, many of which encode MIKC-type MADS-domain transcription factors. Changes in these gene regulatory networks are underlying the morphological evolution of flowers and hence the generation of floral biodiversity. The interactions between floral developmental control genes have so far mainly been defined genetically. However, to better understand the molecular evolutionary dynamics of the gene regulatory networks, its "hard-wiring" has to be determined, i.e. the protein-protein and protein-DNA interactions on which the network topology is based. Of central interest are the floral homeotic proteins, which form multimeric complexes ("floral quartets") specifying angiosperm floral organ identity. They do so by activating and repressing appropriate target genes during the development of floral organs. Some complexes composed of MIKC-type proteins are not only required, but also sufficient to specify floral organ identity.

Within the project, protein-protein and protein-DNA interactions of gymnosperm MIKC-type proteins are studied. Extant gymnosperms are probably the sister group of flowering plants (angiosperms) and possess already putative orthologues of some angiosperm floral homeotic genes. However, the reprocuctive organs of gymnosperms lack typical and central features of angiosperm flowers, like carpels, a perianth, and the bisexual organisation of the flower. By examing the interaction network of gymnosperm MIKC-type proteins and comparing it to the angiosperm network, we hope to better understand the evolutionary origin of the floral quartets. Eventually, this may also shed light on the origin of the angiosperm flower. Major techniques being used include yeast n-hybrid analyses (n = 2, 3, 4), gel retardation assays, and co-immunoprecipitation assays. Plans for the future include tests of protein-protein interactions in plants cells employing bimolecular fluorescence complementation (BiFC).

Publications

Wang YQ, Melzer R, Theissen G (2011) A double-flowered variety of lesser periwinkle (*Vinca minor* fl. pl.) that has persisted in the wild for more than 160 years. *Ann Bot* 107(9), 1445-1452. Details PubMed

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