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Metabolic Signaling from Utrecht to Umeå

Plant metabolism is dynamic and changed metabolite levels affect growth and development and in an applied perspective yield. We are interested in the regulation of metabolism and the impact of changed metabolite levels on signaling. Specifically we focus on:

Sucrose Regulated Translation of bZIP Transcription Factors

Increased sucrose levels inhibit translation of S1-bZIP transcription factors. The mechanism is dependent on upstream open reading frames in the 5' leader of the messenger. Based on mutation analysis we presented a model in which sucrose dependent stalling of the ribosomes inhibits further translation of the bZIP messenger (Rahmani et al., 2009). Currently we are identifying factors involved in the stalling mechanism by yeast-two-hybrid and immunoprecipitation.

Metabolic Reprograming by Sucrose Controlled bZIP Transcription Factors

Over-expression of S1-bZIP transcription factors such as bZIP11 in Arabidopsis dramatically inhibits growth. The main effect of bZIP11 activation is reprogramming of primary metabolism. The levels of several metabolites are affected, including carbohydrates and amino acids (Ma et al., 2011). How the metabolic changes affect growth is under investigation.

Fructose Signaling - Revealed by Natural Variation in Arabidopsis

In contrast to glucose, fructose has never been connected in signaling despite its importance in metabolism and high cellular concentration. A locus of the Cap Verde Island accession (Cvi-0) was found to mediate fructose resistant phenotype in a natural variation based screen. Further fine-mapping revealed the Cvi-0 loci to encode a truncated form of the *NAC089* gene in which the inhibitory domain is deleted. Overexpressing the Cvi-0 *NAC089* gene in sensitive accessions such as Ler and Col-0 mediate fructose insensitive germination phenotype (Li et al., 2011). We are now further characterizing the signaling pathway by determining the *in vivo* targets of the *NAC089* transcription factor.

Currently, we are located in Utrecht (the Netherlands) and moving to UPSC. The talk will serve as an introduction and further details could be found in the posters presented by the group.

References:

- Li P, Wind JJ, Shi X, Zhang H, Hanson J, Smekens SC, Teng S** (2011) Fructose sensitivity is suppressed in Arabidopsis by the transcription factor ANAC089 lacking the membrane-bound domain. *Proceedings of the National Academy of Sciences of the United States of America* **108**: 3436-3441
- Ma J, Hanssen M, Lundgren K, Hernandez L, Delatte T, Ehlert A, Liu CM, Schlupepmann H, Dröge-Laser W, Moritz T, Smekens S, Hanson J** (2011) The sucrose-regulated Arabidopsis transcription factor bZIP11 reprograms metabolism and regulates trehalose metabolism. *The New phytologist* **191**: 733-745
- Rahmani F, Hummel M, Schuurmans J, Wiese-Klinkenberg A, Smekens S, Hanson J** (2009) Sucrose control of translation mediated by a uORF encoded peptide. *Plant Physiol.* **150**: 1356-1367