**Update on the interplay of signals controlling shoot branching in plants – challenges and solutions for predicting network perturbations**

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The number of branches on a plant is a highly plastic trait that impacts yield and ornamental value of most plant species. An overview of the stepwise development of the current model/network for shoot branching will be presented [1]. Apical dominance, a form of branching control by the shoot tip, is regulated by the shoot’s demand for resources for growth, particularly sugars. Auxin produced by the shoot tip acts to reinforce this dominance. Acting in an opposing manner, sugars and auxin regulate the levels of cytokinins that move upwards into buds to promote bud outgrowth. The strigolactone pathway act antagonistically with cytokinins and is also suppressed by major plant resources such as nutrients and sugars. Once a bud is induced to grow, local auxin content sustained at high enough levels will maintain vascular development and sustained growth through promoting auxin canalisation and ensuring gibberellin levels required for sustained growth [2]. The current knowledge of this network is quite complex and it is not trivial to interpret the effects of multiple perturbations. As crops and natural selection rely on the emergent properties of networks, such as the branching network, our current work focusses on how to understand the structure of network and its connectivity - the details of which are critical but not individually sufficient to solve wicked problems such as predicting what gene perturbations and combinations will successfully improve crops in particular environments.

***References:***

[1] Beveridge CA, Rameau C, Wijerathna-Yapa A. 2023. Lessons from a century of apical dominance research. Journal of Experimental Botany, 74:3903-3922.

*[2] Cao D, Chabikwa T, Barbier F, Dun EA, Fichtner F, Dong L, Kerr SC, Beveridge CA. 2023. Auxin-independent effects of apical dominance induce changes in phytohormones correlated with bud outgrowth. Plant Physiology 192, 1420–1434.*