Activity to accompany Regulation of Flowering by Trehalose-6-Phosphate Signaling in *Arabidopsis thaliana*.

Ask your students to imagine that they were plant physiologists, and to propose a research study that would follow up on that of Wahl *et al.*

Additionally, students could be asked to evaluate proposals such as the student-generated ones shown below.

Follow-Up Question	**Follow-Up Experiment**
Could high levels of trehalose 6-phosphate (T6P) cause flowering of seedless vascular plants such as ferns?	Create a genetically engineered fern that includes a gene for high expression of trehalose 6-phosphate synthase 1 (TPS1). Determine whether T6P is produced by the ferns, and whether there are any signs of flower formation.
Do *T6P* levels affect root growth as well as shoot growth? ***	Use *A. thaliana* mutants that either overexpress or underexpress *TPS1* (as seen in the Wahl *et al.* study). Measure root hair density and root biomass in the mutants and note any differences relative to wild-type *A. thaliana*.
Can enhancing *TPS1* activity lead to faster growth of an agriculturally important crop like corn?	Genetically engineer corn to overexpress *TPS1*. Compare growth rate and progression to flowering in wild-type and mutant corn. ###
Can enhancing *TPS1* activity lead to greater production of an agriculturally important fruit like strawberries?	Genetically engineer strawberries to overexpress *TPS1*. Compare strawberry production in wild-type and mutant plants.
Is flowering more dependent on some nutrients than others?	Grow *A. thaliana* either with regular soil or with reduced amounts of nitrogen, potassium, calcium, magnesium, phosphorus, or sulfur. Determine when flowers appear and how many appear under each condition. In this way, find out whether restricting one nutrient impacts flowering more strongly than restricting other nutrients.
Does flowering also depend on auxin, a hormone that regulates many aspects of plant development?	Suppress expression of the auxin receptor TRANSPORT INHIBITOR RESPONSE 1 (TIR1) in floral meristems of *A. thaliana*. Determine whether this delays or prevents flowering.
Does T6P control flowering in plants other than *A. thaliana*?	Study *Capsella rubella*, a close relative of *A. thaliana*, and the Gerbera daisy, which is not closely related but is a commercially important flower. Measure T6P levels during flowering to see whether they correlate with flower development, as in *A. thaliana*. Also use RNAi to suppress TPS1 expression; determine whether this prevents or delays flowering.
How temperature-sensitive is *TPS1*? (Could global warming disrupt the T6P signaling pathway)	Clone, express, and purify the *TPS1* and *TPP* genes in *E. coli*. Then characterize the temperature sensitivity of both enzymes in vitro.

*** This has been done in the original publication that characterized the dexamethasone-inducible TPS1 line (tps1-2 GVG:TPS1). Van Dijken et al., *Plant Physiology* 2004

And yes, root development is affected by loss of TPS1

Interesting idea; the role of TPS1 in the development of monocotyledonous plants has not been studied in detail (as far as I know); that should be done before one could attempt to modify the TPS1/T6P levels in corn.

What is known is that T6P is linked to inflorescence architecture in corn (the RAMOSA 3 gene encodes a trehalose-6-phosphate phosphatase)

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