



An In-Vitro system to study plant stem cells. Exogenous application of phytohormones such as auxin and/or cytokinin can induce either root formation or somatic embryo formation in model legume *Medicago truncatula*.

Our Group focuses on the processes involved in plant meristem development and plant responses to bacterial infection. We are investigating the nodule meristem formed on legume roots by *Rhizobium* infection, the interaction of *Rhizobium* with rice plants and root biology.

Our research utilises two interacting, well-characterised model organisms—the legume *Medicago truncatula* and the soil bacteria *Sinorhizobium meliloti*. With these we are able to assess the role of specific genes, gene products and signalling molecules that regulate growth and development.

One of our aims is to isolate and characterise novel peptide signal molecules that may act as regulators of proliferating meristemic cells and their differentiation. Knowledge of these peptide signals and the control of meristem communication is the key to manipulating plants for adaptation to the Australian environment and for the production of pharmaceuticals.

GENOMIC INTERACTIONS

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HIGHLIGHTS

- Reprogramming of somatic cells of *Medicago truncatula* to give rise to somatic embryos or roots involves several steps: de-differentiation, reprogramming, commitment, cell division and differentiation. Using transcriptomic and proteomic approaches, we have identified proteins/genes involved in gene regulation, signal transduction, cell proliferation, stress and defence that may play critical roles in cellular commitment during embryogenesis and root organogenesis.
- In *Medicago truncatula*, transcription of the Baby Boom gene thought to encode a transcription factor that initiates embryogenesis, was induced by auxin and inhibited by cytokinin. This indicates that there is a fine balance between these two phytohormones in embryo formation.
- Two *Medicago truncatula* mutants, sickle (*skl* ethylene-insensitive) and *sunn* (super numeric nodules), are hypernodulating mutants which can be distinguished by anatomical, genetic, physiological and molecular criteria. The *sunn* mutant has an increased auxin transport capacity while the *skl* mutant also has a *Rhizobium*-induced alteration in its polar auxin transport.
- The primary root apical meristem of *Medicago truncatula* is initiated during embryogenesis and lateral root meristems after embryogenesis. Comparisons, using 2D-gel electrophoresis, were made of the meristematic and non-meristematic tissues from primary and lateral roots and were extended by the use of the herbicides, flumetsulam and metsulfuron methyl, which inhibit the enzyme acetolactate synthase and cause meristem abortion. Compared to differentiated tissues, the meristems contained increased cell division and redox mediating proteins. There was also an increase in pathogenesis, or stress related proteins, and a decrease in cell division related proteins in the meristems of herbicide treated root.