# Getting to the root of nutrient sensing

June 14 2010

New research published by Cell Press in the June 15th issue of the journal *Developmental Cell*, reveals how plants modify their root architecture based on nutrient availability in the soil.

Plants obtain most necessary nutrients by taking them up from the soil into their roots. Although plants cannot move to a new environment when nutrient availability is less than favorable, they can modify their development to favor root colonization of soil areas where nutrients are abundant. Therefore, plants perceive the availability of external nutrients, like nitrogen, and couple this nutrient sensing to an appropriate adaptive response.

In *Arabidopsis*, the 'lab rat' of the plant world, lateral root growth is induced in nitrate-rich patches of soil. "Nitrate is the main nitrogen source for these plants and a signaling molecule that regulates growth and metabolism," explains senior study author Dr. Alain Gojon from the Plant Biochemistry and Molecular Physiology Department in Montpellier, France. "In *Arabidopsis*, the NRT1.1 nitrate transporter is crucial for nitrate signaling stimulating root growth."

Dr. Gojon's group was interested in investigating how NRT1.1-dependent stimulation of lateral root growth works. They discovered an unexpected connection between NRT1.1 and auxin, a plant hormone that plays a key role in root development. The researchers found that in addition to transporting nitrate, NRT1.1 also facilitates auxin transport. When external nitrate concentrations are low, NRT1.1 represses auxin accumulation in lateral roots and inhibits lateral root

growth. A high nitrate concentration or disruption of the NRT1.1 gene suppresses NRT1.1-dependent auxin transport and auxin accumulates in lateral roots, which then grow out into the soil.

Taken together, the results indicate that NRT1.1 regulates root branching by exerting nitrate-dependent control of auxin accumulation in lateral roots. "We propose that NRT1.1 represses lateral root growth at low nitrate availability by promoting auxin transport out of lateral root tips and towards the base of the root. Thus, high nitrate availability stimulates lateral root growth by inhibiting NRT1.1-dependent auxin transport and allowing auxin accumulation in root tips," says Dr. Gojon. "This defines a mechanism connecting nutrient and hormone signaling during organ development."

**More information:** Krouk et al.: “Nitrate-Regulated Auxin Transport by NRT1.1 Defines a Mechanism for Nutrient Sensing in Plants.” Publishing in Developmental Cell 18, 927-937, June 15, 2010. DOI 10.1016/j.devcel.2010.05.008

Provided by Cell Press