MicroRNA can move between cells

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(PhysOrg.com) -- MicroRNAs can move between cells and play a role in their communication. This discovery was made by plant researchers at Uppsala University together with colleagues from Finland and the US when they were studying mechanisms that control the development of plant roots. The study is published in the Web edition of the journal *Nature*.

MicroRNAs are important for gene regulation, for example during various developmental processes in animals and plants. Researchers have previously assumed that microRNAs are active only in the cells in which they are produced, but these new research findings show that they can function in communicating positional information between cells. The study is a collaboration between four research teams at Uppsala University, University of Helsinki, Duke University, and the Boyce Thompson Institute. From Uppsala Anneli Carlsbecker and her PhD student Christina Joy Roberts participated.

“We have been able to see how a cell layer in a plant’s root sends a signal to another cell layer, which in turn answers. One of these signals consists of a microRNA moving between the cells,” explains Annelie Carlsbecker, assistant professor at the Department of Physiological Botany, Evolutionary Biology Centre in Uppsala and one of the main authors of the study.

The process the scientists are describing takes place during the formation of the water-conducting vessels and the cell layer that forms an insulating coating around the conducting tissues, enabling the plant to

control its uptake of water and minerals. The study shows that microRNAs move in one direction between the cell layers and a regulatory protein moves in the opposite direction. In this way the cells communicate their relative positions and ensure that the cells attain their proper identity.

The evolution of the rigid water-conducting cells, so-called xylem cells, and the insulating coat of cells that surrounds them was a milestone in the adaptation of plants to terrestrial growth. It allowed a shift from the requirements of growing in the immediate vicinity of water, like mosses, to more advanced plant forms. With a water conducting system, the plants could survive a dryer climate and grow to considerable sizes, as water now could be transported to all parts of the plant.

“Both the microRNA and the regulatory proteins we have studied are evolutionarily conserved, implying that this type of communication between cells might have developed very early in the evolution of plants” says Annelie Carlsbecker.

The mechanisms for how microRNAs move between cells are not yet clear, but it is probable that their role is to adjust and finely tune the levels of expression of the factors it controls. Through their movement from an outer cell layer into the inner conducting tissues, the microRNAs control the levels of the target factors that determine the identity of the xylem cells. In this manner, the xylem cells in peripheral and central parts of the root take on different identities.

“This way of stabilizing boundaries between cells is generally important during developmental processes in both plants and animals. It’s possible, even probable, that microRNAs can behave in a similar way in other developmental processes as well,” says Annelie Carlsbecker.

More information: www.nature.com/nature/journal/ …

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