# Plant organ growth is not so different from animals

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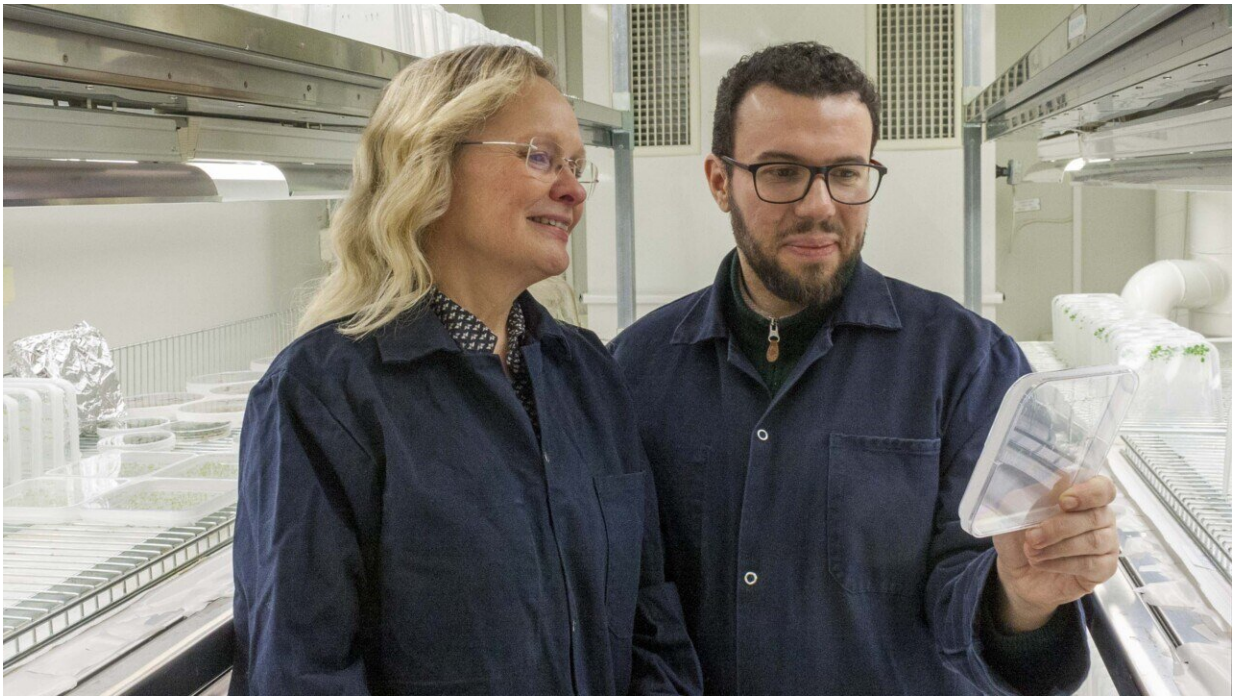

Hannele Tuominen and Sacha Escamez, UPSC. Credit: Anne Honsel

For a long time, researchers assumed that cell death occurs mainly during animal organ growth, but not in plant organs. A research group led by Hannele Tuominen from UPSC has now demonstrated that the death of certain cells in the root facilitated the growth of lateral roots. These new findings hint at organ growth of plants and animals might not be so different as thought. The study was published today in the journal

*Current Biology*.

In contrast to animals, plants form new organs like lateral roots continuously. These roots grow out from the main root and explore the soil for nutrients while providing additional stability to anchor the plant in the soil. Elimination of cells plays an important role in animal development, e.g., for the formation of fingers or toes. The cells between the digits die during development to allow the establishment of the individual digits. , Developmental cell death also occurs in plants, but so far, it has been unclear whether this is needed to facilitate the emergence of lateral roots.

The researchers around Hannele Tuominen, until 2019 associate professor at Umeå University and now professor at SLU, and her postdoc Sacha Escamez, used different methods to demonstrate that cell death occurs and enables lateral roots to emerge from the main root in thale cress plants.

"We first found that genes indicating developmental cell death were activated in cells that are laying over those cells that form the future lateral roots," says Hannele Tuominen. "That made us curious, and we wanted to analyze this in more detail."

The researchers used microscopic techniques to show that those cells were actually dying. They applied dyes that stain either living cells or dead cells and fluorescent markers that are only visible at certain pH values. Important parts of the plant cells become acidic when the cell dies, causing the signal from the marker to disappear.

To establish this effect more firmly, the researchers used an additional approach. They analysed a thale cress mutant lacking a cell-death-regulating protein. The growth of lateral roots in this mutant was delayed. The researchers could restore the normal development

genetically and also physically by using optical tweezers.

In the genetic approach, they introduced a mammalian gene known to induce cell death into the mutant and targeted it to affect only those cell types that they observed to die in the non-mutated plants. The lateral roots of the resulting double mutant grew normally without any delay.

In parallel, the researchers applied optical tweezers to wound cells and like this induce the death of the cell. Optical tweezers use a highly focused laser beam to manipulate microscopically small objects. "This is a very precise optical tool. We can target individual cells and wound them. Three hours after we wounded the cells, they died," explained Sacha Escamez. "When we applied this method to the mutant whose lateral roots normally grow slower, their lateral roots grew significantly faster."

**More information:** Sacha Escamez et al. Cell Death in Cells Overlying Lateral Root Primordia Facilitates Organ Growth in Arabidopsis, *Current Biology* (2020). DOI: 10.1016/j.cub.2019.11.078

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