# Biologists find how plants reconstitute stem cells

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Stem cells are typically thought to have the intrinsic ability to generate or replace specialized cells. However, a team of biologists at NYU showed that regenerating plants can naturally reconstitute their stem cells from more mature cells by replaying embryogenesis.

"Paradoxically, this means that, in this system, stem cells don't immediately generate the plant's tissue, but, rather, tissues make stem cells," explains Kenneth Birnbaum, an associate professor in New York University's Department of Biology and the study's senior author.

In the study, which appears in the journal *Cell*, researchers studied plant root regeneration using lineage tracing to determine the origin of cells, live imaging to observe the dynamical reassembly of tissues, and single cell RNA sequencing to analyze cells in transition during regeneration.

The group found that, after severe damage removed all stem cells of the root, new stem cells were recruited from many different types of cells that had already specialized. To do this, the plant replayed the steps of embryogenesis, first creating specialized tissues that, once assembled, generated a new set of stem cells. This showed that the important ingredient for long-term growth was not necessarily a stem cell imbued with cell-production properties, but, instead, the surrounding tissues that together created stem cell behavior.

The work has implications for how plants maintain their notoriously long-term growth and productivity. In addition, the ability of many cells to

orchestrate regeneration also has implications for important food crops, like cassava, which are cultivated through regeneration.

"The plant has an amazing capacity to repair itself, but there are animal systems that bear some resemblance to the plant's way of recreating stem cells on the fly," explains Birnbaum.

For example, he notes, recent studies in mice showed that adult hair and intestinal cells could "reconstitute" their stem cells.

"We can't assume that plant genes will help human regeneration, but the principles involved in plant stem cell reconstitution could serve as a general model," he observes.

"An interesting aspect is that plant regeneration repeats embryonic signaling on a different scale," Birnbaum adds. "Specifically, events that occur in single cells in the embryo also occur over many cells in the larger damaged tissue. It is as though the plant can superimpose embryonic development on a new scale that is adaptable to the damaged tissue. That gives the plant tremendous flexibility in repairing damaged body parts."

Provided by New York University

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