

## **Biologists find stem cell-like functions in other types of plant cells**

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Ordinary cells have the ability to replace lost organs in plants—a function previously thought to be limited to stem cells—researchers at New York University's Center for Genomics and Systems Biology and Utrecht University in the Netherlands have found. The findings, which suggest that some roles of stem cells in organ regeneration may be shared by other types of cells, are published in the latest issue of the journal *Nature*.

Stem cells have two known fundamental properties: they can renew themselves and they can give rise to specialized cells. These traits make them the engines for regeneration, creating new cells to replace lost organs and tissue. These phenomena are especially evident in plants, which continually re-grow their branches and roots. The center of stem cell activity is a stem cell niche, where stem cells are directed to perform these renewal and regeneration functions.

However, it's unclear how significant the stem cell niche is to organogenesis—the building and rebuilding of organs.

The scientists studied the plant Arabidopsis thaliana. The species is a good candidate for study because researchers have previously identified all of the genes expressed in its individual cells, which allows tracking of cells' identity as they regenerate.

In the study, the researchers cut off the plant's root tip, thereby excising the stem cell niche, and examined the return of cell identities by



measuring all gene activity. The results suggested that stem cells returned quite late in regeneration after other cells were already replaced. The researchers then used mutant plants in which the stem cell niche no longer functions to confirm their initial observations. Despite the absence of the stem cell niche, the plant's ordinary cells worked to regenerate all the major tissues constituting the root tip—a process that began hours after it had been removed.

However, researchers found that plants without functional stem cell niches could not resume normal growth, showing that other cells did not replace all functions of stem cells.

Scientists have recently shown that manipulating non-stem cells in mammals to express several genes could convert those cells into stem cells—a process known as reprogramming. In 2008, a *Nature* study conducted at the Harvard Stem Cell Institute recreated pancreatic cells in mice into another type of cell that produces insulin without the aid of stem cells. In the NYU-Utrecht study, the researchers sought to determine if entire organs regenerate in plants absent of stem cells without using genetic manipulation.

"You could think of these findings as a massive reprogramming of an organ's identity without the need for a stem cell niche," said Kenneth Birnbaum, an assistant professor of biology at NYU whose lab conducted the research. "Here is a case of an organism that can perform this kind of reprogramming naturally. This may be one reason why plants are so adept at regenerating their body parts."

Source: New York University

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