

Scientists crack the code to regenerate plant tissues

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Arabidopsis thaliana. Credit: Wikipedia.

Plant regeneration can occur via formation of a mass of pluripotent cells. The process of acquisition of pluripotency involves silencing of genes to

remove original tissue memory and priming for activation by external input. Led by Professor Sachihiro Matsunaga from Tokyo University of Science, a team of scientists have shown that plant regenerative capacity requires a certain demethylase that can prime gene expression in response to regenerative cues.

In [multicellular organisms](#), not all genes are expressed in all cells, meaning that not all cells make the same enzymes or proteins, and therefore, not all cells have the same metabolism. This differentiation is a key process across multicellular organisms, including plants and fungi. But as cells specialize, they become unipotent, meaning that they lose the ability to form multiple cell types. For a long time, scientists have tried to reprogram mammal cells for pluripotency by drastic means such as nuclear transfer and induction of transcription factors. However, plants can acquire the same regenerative powers via external signal input such as hormones and stress. A part of the phenomenon is regulated by epigenetics, because these modifications are epi or "upon" the genes.

Professor Matsunaga and his team used *Arabidopsis thaliana*, a small flowering plant commonly used in [plant biology](#), to study genome-wide histone modifications. Histones are proteins that package together eukaryotic DNA, preventing it from being transcribed or decoded. Upon modification, however, these proteins' grasp around the DNA molecule loosens, making it easier for the DNA to be transcribed. The group of scientists found that it is the demethylation (the removal of a methyl group from the amino acid) of the histone H3 by the LDL3 enzyme that lends regenerative competency to the plant. This epigenetic mechanism allows the plant's pluripotent cells to go back to its unipotent state and thus assume the identity of shoot meristems for differentiated tissues including leaves and stems.

Because no seeds are needed to grow these plants, this could potentially help scientists grow plants faster without flowering. "By strengthening

the ability of plants to reproduce, even without seeds," Professor Matsunaga indicated, "it is possible to increase the number of clonal [plants](#) with only leaves, stems, and parts of roots. It can address [environmental problems](#) by promoting greening and solve the global food shortage problem by increasing production of grains and vegetables."

More information: Hiroya Ishihara et al, Primed histone demethylation regulates shoot regenerative competency, *Nature Communications* (2019). [DOI: 10.1038/s41467-019-09386-5](https://doi.org/10.1038/s41467-019-09386-5)

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