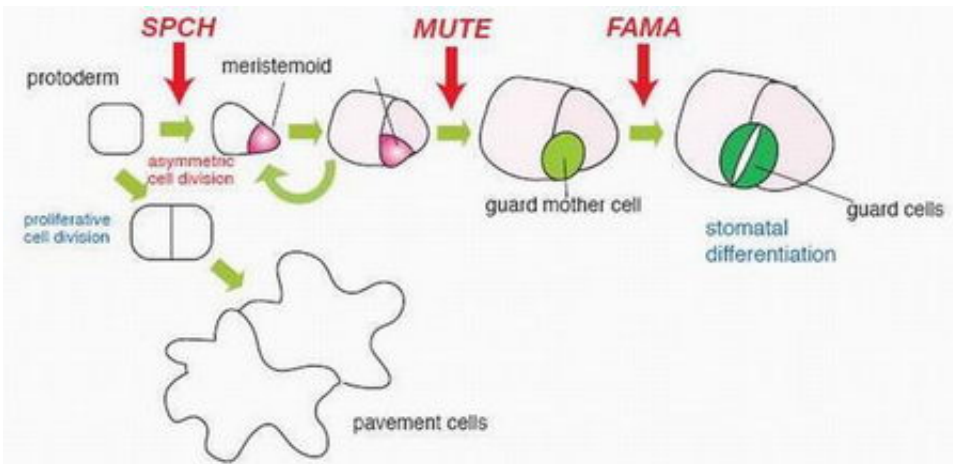


'Speechless' and 'Mute' help break the silence of the leaves

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The gene *Speechless* drives the division that initiates stomatal development. (Without *Speechless*, cells become the wax-coated, interlocking pavement cells on the surface of the plant, none of which open or close.) Two or three divisions after *Speechless*, *Mute* causes the formation of a guard mother cell. Then *Fama* causes the guard mother cell to divide into two equal guard cells that, as their name implies, guard the opening of the stomatal pore. Credit: University of Washington

Researchers have discovered two genes that guide land plants to develop microscopic pores that they can open and close as if each pore was a tiny mouth. Plants wouldn't have been able to move from water to land 400 million years ago if they hadn't evolved this ability, which protects them from losing too much moisture.

The leaves and stems of land plants are dotted with the "tiny mouths," called stomata. When open, stomata allow the plant to take in carbon dioxide gas needed for photosynthesis and allow moisture to evaporate, pulling water from the roots into the plant. But when too much moisture is being lost, the two cells around the stomatal pore close it completely.

Without the genes guiding stomatal development, plants won't develop any mouthlike pores, hence the names Speechless and Mute for the newly discovered genes, according to Keiko Torii, a University of Washington associate professor of biology.

Her UW group and a Stanford University group have separate papers in the journal Nature's advance-online publication Dec. 20. Each group describes independently finding the gene that came to be called Speechless and its role in initiating the process that leads to stomata.

In addition, Torii's UW group is publishing findings in its Nature article about another gene, one they named Mute, that triggers the key middle step that decides when a cell will fully become a stomata. Earlier this year the Stanford group published findings about the gene that controls the final step in stomata development, called Fama.

"In the last few months, we've gone from knowing surprisingly little about the genes involved to knowing all three major factors -- Speechless, Mute and Fama," says Lynn Pillitteri, a research associate in biology and lead author of the *Nature* paper.

That the three are so closely related will be of interest to biologists studying both plants and animals, she says. Each is a basic protein with a helix-loop-helix domain, a sequence that is quite ancient and controls a vast range of physiological and developmental processes. Speechless, Mute and Fama also have very similar DNA sequences and could have arisen from a single gene that replicated and evolved, giving plants

additional genes with slightly different characteristics.

Having two or three genes with similar characteristics would give plants what Torii terms "the freedom to play, to make functions that are the more elaborate stomata in modern plants."

Other biologists have seen something similar in animals. The ability to differentiate cells that become muscles also is controlled by consecutive action of basic helix-loop-helix proteins with DNA closely related to each other.

Molecular conservation of such key regulatory genes between plants and animals -- genes that switch on and off cell-type differentiation programs from precursor stem cells -- is intriguing and exciting, Torii says.

In addition to Pillitteri and Torii, who is the corresponding author, the other co-authors are Daniel Sloan, a former UW technician now pursuing a doctorate at University of Virginia, and Naomi Bogenschutz, a research technician.

Source: University of Washington

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