

# How does inbreeding avoidance evolve in plants?

June 10 2013

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Inbreeding is generally deleterious, even in flowering plants. Since inbreeding raises the risk that bad copies of a gene will be expressed, inbred progeny suffer from reduced viability.

Many [flowering plants](#) are able to recognize and reject their own pollen, thereby preventing inbreeding despite the plants' hermaphroditic nature. This mechanism is a complex trait that involves the interaction of a gene that tags the pollen with an identifier molecule, and a gene that produces a molecule capable of detecting pollen produced by the same plant.

[Evolutionary biologists](#) have often argued that once complex traits are lost, they are seldom regained. But a new study, led by biologists at McGill University and published in the journal *PLOS Biology*, suggests that this may not be the case for self-pollen recognition.

In the [evolutionary lineage](#) leading to the genus *Leavenworthia* (a plant group related to [canola](#) and cole crops such as broccoli and cabbage), the ancestral genes that code for self-pollen recognition were lost. But the self-pollen recognition function in *Leavenworthia* appears to have been taken up by two other genes that originally may have had a different role—for example, in pathogen recognition.

"Self-incompatibility," the pollen-[recognition system](#) that enables plants to avoid the inbreeding caused by self-pollination, involves a pair of tightly linked genes known as the S locus. In this study, the researchers analyzed the [gene sequence](#), genome organization, and gene [evolutionary](#)

[history](#) of S loci in members of the Brassicaceae family, which includes plants of the genus *Leavenworthia*.

"We conclude that both genes that comprise the ancestral S locus in the Brassicaceae were lost in *Leavenworthia*," says McGill researcher Sier-Ching Chantha, lead author of the study. Our analyses show, however, that plants of this genus have two other linked genes that exhibit patterns characteristic of an S locus. These genes occupy the same genomic position in *Leavenworthia* as do two non-S-locus genes in a related species. We suggest that these genes have evolved to assume the function of the pollen recognition system of self-incompatibility in *Leavenworthia*."

How plants avoid [inbreeding](#), and the related topic of S locus evolution have been important research subjects for plant biologists. There can be hundreds of variants of a single S-locus in individual plant populations—a very unusual situation. In the animal world, a similar phenomenon is the many variations in immune-system genes. Immune system genes in animals, like the S locus in plants, are also involved in recognition, though in the case of immune genes it is foreign antigens rather than pollen types that are recognized. It seems that the recognition function can act in both systems to allow the evolution of large amounts of genetic diversity.

"François Jacob, the famous French biologist, once compared the action of natural selection to that of a tinkerer who uses the materials around him to produce a working object," notes McGill biology professor Daniel Schoen, the corresponding author of the study. "The evolution of the genes involved in self-pollen recognition in *Leavenworthia* provides a compelling example of this idea, and lends credence to the notion that the loss of complex traits may not always be irreversible."

**More information:** [www.plosbiology.org/article/info](http://www.plosbiology.org/article/info)

%3Adoi%2F10.1371%2Fjournal.pbio.1001560

Provided by McGill University

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