The half-life of E-cadherin decreased and its localization at cell–cell contacts was less regular. The authors showed this to be the result of increased internalization of E-cadherin, and the net effect of this was to compromise cell aggregation and to increase cell scattering.

The authors therefore propose that Hakai functions to regulate cell motility by inducing ubiquitylation and endocytosis of E-cadherin. In response to tyrosine-kinase-mediated E-cadherin phosphorylation, Hakai is recruited — through SH2-domain interactions — to E-cadherin, where it functions as an E3 ubiquitin ligase to promote its ubiquitylation and subsequent endocytosis from cell–cell contacts.

Katrin Bussell

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PLANT ION CHANNELS

A potent fertilizer

Although you're unlikely to ever catch a plant reading the *Kama Sutra*, it appears that there is a way for plants to improve their reproductive success. When pollen grains land on a compatible stigma, they germinate and, by each growing a tube that elongates towards the ovary, they compete with one another to fertilize an ovule. In *Genes and Development*, Sentenac and colleagues report the first molecular identification of a pollen ion channel, and show that it is important for pollen tube development and therefore pollen competitive ability.

Based on the findings from the *Arabidopsis* Genome Initiative, Sentenac and co-workers cloned the full-length open reading frame of a gene likely to encode a K^+ channel of the Shaker family. To investigate the expression of this channel, the authors used transgenic plants carrying a *β-glucuronidase* (*GUS*) reporter gene under the control of the channel's promoter. They detected GUS staining only in pollen, and also observed this staining in the pollen tube after germination.

The authors expressed the gene in mammalian COS cells to functionally characterize the channel. Using electrophysiological analyses, they showed that it is a slowly activating, inward-rectifying K^+ channel, and that channel activation occurs independently of the external K^+ concentration. These observations led to the channel being named Shaker pollen inward K^+ channel (SPIK).

To determine the function of SPIK in plants, Sentenac and colleagues identified a SPIK-mutant *Arabidopsis* line, named *spik-1*. They did not observe any obvious phenotype differences on comparing wild-type and mutant plants. However, when they investigated K^+-channel activity in the pollen-grain membrane of *spik-1* plants, they found that the inward K^+ current was strongly reduced and they no longer observed the slowly activating, inward-rectifying component.

Sentenac and co-workers then looked at pollen grain germination and tube development *in vitro*, and found that the *spik-1* mutation had a negative effect on the overall germination rate, irrespective of the external K^+ concentration. They also found that it resulted in a strong decrease in the number of developed pollen tubes, and that the developed tubes were consistently shorter in homozygous *spik-1* plants compared with wild-type plants. The latter effects were dependent on external K^+, with lower concentrations resulting in shorter tubes for both wild-type and mutant plants.

By analysing the transmission rate of the *spik-1* allele in heterozygous plants, the authors showed that the probability of fertilization by the mutant pollen is ~1.6 times lower than by wild-type pollen, and concluded that the *spik-1* allele results in a decrease in pollen competitive ability.

The mechanisms specifically involved in controlling pollen-tube growth rate, and hence pollen competitive ability, have remained poorly documented, so the first molecular identification of an active ion channel in pollen — SPIK — is an important result. SPIK is likely to be involved in K^+ uptake in growing pollen tubes. By ensuring that a pollen tube develops as rapidly as possible, SPIK increases pollen competitive ability and hence improves a pollen grain's chance of reproductive success.

Rachel Smallridge

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Pollen: structure, development and function | Voltage-gated potassium channels