Genes prevent inbreeding, aid development

Just as butterflies have harnessed genetic material essential in development to also create beautiful wing patterns (SN: 7/9/94, p.23), plants, too, have evolved new uses for existing genes. Scientists studying the genes that help some kinds of mustard plants avoid self-fertilization have new evidence that at least one of those genes helps form the shape of the much-studied *Arabidopsis,* also of the mustard family.

An understanding of these genes and how they work is aiding the study not only of fertilization, but also of plant development and cell recognition, says June B. Nasrallah of Cornell University.

Like many plants, mustard flowers contain both male (pollen-producing anthers) and female (ovule-containing pistils) parts, making possible self-fertilization. Plants such as *Arabidopsis* survive just fine whether fertilized by their own or another *Arabidopsis'* pollen. But for others, including mustards in the *Brassica* genus, inbreeding leads to ever more sickly descendants.

So it's no surprise that protective self-incompatibility mechanisms have evolved many times in the plant kingdom (SN: 2/19/94, p.117). In *Brassica* species, it's likely that a pollen protein mobilizes messenger molecules in the pistil that tell the plant to reject this grain, Nasrallah reported last week in San Francisco at the annual meeting of the Society for Cell Biology.

Her team previously had identified two proteins involved in conveying this rejection message. Their genes, and possibly a third gene, exist quite close together on one chromosome and are passed along as a unit during cell division, she now reports. Furthermore, each *Brassica* plant inherits 1 of 60 versions of this genetic unit. As a result, each of those genes' proteins differ slightly from one individual in a species to the next — just enough that a given plant can tell if incoming pollen is its own.

In essence, these units form the basis of a cellular identification system. "It's a self-nonself recognition system, very much like immune systems in animals," comments Teh-hui Kao of Pennsylvania State University in University Park. Like immune systems, plant recognition is rather complicated, he adds.

One of the three genes specifies a glycoprotein — a protein with a sugar attached. The other gene codes for an enzyme called S-locus receptor kinase. The kinase and glycoprotein look a lot alike and may bind to similar molecules, Nasrallah says. She thinks the putative third gene codes for such a molecule, a pollen protein.

Normally, the glycoprotein resides in the walls of cells at the pistil's tip. Because the glycoprotein dissolves in water, Nasrallah predicts it can relay the pollen's protein from outside the cell wall to the S-locus receptor kinase in the cell membrane. That kinase then stimulates a cascade of chemical reactions that signals the cell to prevent fertilization. Other kinases relay messages similarly in animal cells, likewise helping animal cells communicate, she adds.

Her team now has evidence that S-locus receptor kinase is active at the base of lateral stems in sprouting *Arabidopsis*. At these sites, the kinase may help shape the plant. When the Cornell scientists cause *Arabidopsis* to make too much of the kinase, much smaller cells and dwarf plants result. Perhaps the kinase tells cells to stop expanding, Nasrallah suggests.

"Even though self-compatibility is a very specific phenomenon and restricted to a very specific subset of plants, the genes have been recruited from genes that have a very different function," Nasrallah concludes. — *E. Pennisi*

Nasrallah/Cornell Univ.

Blue shows likely site of self-incompatibility kinase activity at flower's pistil tip.

Astronomers track a new storm over Saturn

It's stormy weather again on Saturn.

Shaped like an arrowhead, the newest storm near the ringed planet's equator resembles "a cloud of smoke from a giant cigar," says amateur astronomer Donald C. Parker of Coral Gables, Fla.

First sighted in July and imaged this month with the Hubble Space Telescope, the storm may have resulted from a "burp" of gas left over from a larger Saturnian storm in 1990 (SN: 10/13/90, p.228), notes Reta F. Beebe of New Mexico State University in Las Cruces.

The Hubble image reveals that the storm, although smaller than the 1990 event, stretches about 12,700 kilometers from east to west, a distance roughly equal to Earth's diameter. Beebe suggests that the cloud formed when a bubble of warm gas — perhaps a holdover from a larger bubble that emerged 4 years ago — arose from the planet's thick clouds of ammonia ice.

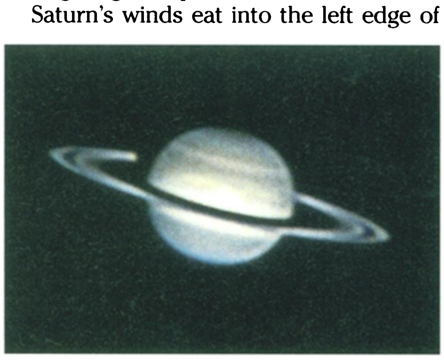
As the bubble punched up through the clouds, expanding and cooling, fresh crystals of ammonia ice condensed within it, giving the spot its white hue.

Saturn's winds eat into the left edge of the storm cloud, forming the wedge, or arrowhead shape, of the storm center. The planet's strongest eastward winds, which blow at 1,700 km per hour, according to Voyager spacecraft measurements from the early 1980s, lie at the same latitude as the arrowhead. North of the arrowhead, the winds blow more slowly, so the storm center outruns the winds just above it.

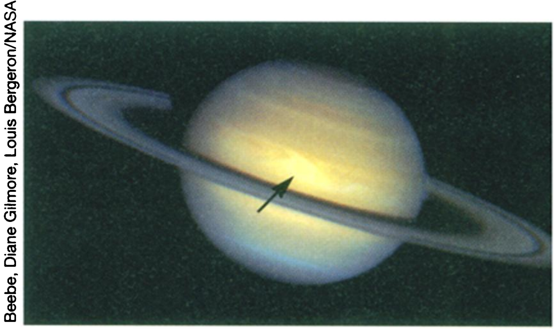
The strong winds at the arrowhead's upper edge push off the slower-moving northern part of the storm. This interaction, akin to what happens when winds in Earth's atmosphere strike a mountain, generates the faint white clouds to the right of the storm center, Beebe says.

Equatorial storms larger than the current one seem to occur every 57 Earth years, or about every 2 Saturnian years, but no one knows why they emerge only during summer and only in Saturn's northern hemisphere. — *R. Cowen*

Image of Saturn, taken Nov. 10 through a 16-inch, ground-based telescope, shows white storm feature near equator (left). Composite image (right), taken by Hubble on Dec. 1, shows the storm's shape (arrow).



Parker



Beebe, Diane Gilmore, Louis Bergeron/NASA