Chromosomes show plants' secret complexity

They make life look so simple, but they do it with an enormous number of genes. One and a half billion years after plants' lineage diverged from ours, our green cousins are finally receiving the credit they deserve.

In a major milestone, nearly 300 researchers working in the United States and Europe have detailed the exact DNA sequence of two chromosomes from a plant. In doing so, they've uncovered a surprisingly dense crowd of genes.

"Plants are a lot more complicated than we give them credit for," comments Elliot M. Meyerowitz, a molecular geneticist at the California Institute of Technology in Pasadena.

Nearly 8,000 genes populate chromosomes 2 and 4 of the wild mustard plant *Arabidopsis thaliana*, the scientists report. The count dwarfs the recent gene estimate of about 550 for human chromosome 22 (SN: 12/4/99, p. 356).

Because *Arabidopsis* has only five chromosomes, it probably doesn't exceed a person in overall genetic complexity. However, worms and flies fall short of matching mustard gene-for-gene, says Meyerowitz.

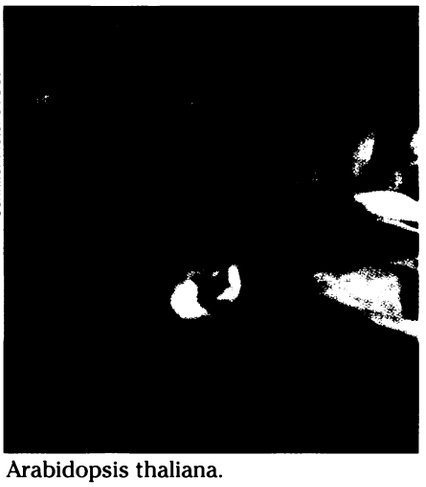
"Plants do a lot of things that animals don't," he adds. For example, plants tune their development to the circumstances into which they are born. "You get a very different plant in cold or warm, light or shade—but a fly is a fly every time," he says.

Separate teams of scientists tackled chromosomes 2 and 4 of *Arabidopsis*. Both groups report the sequences they elucidated in the Dec. 16 NATURE. Additional scientific teams scrutinizing the mustard plant's three remaining chromosomes expect to complete the task within a year.

The scientists made mustard their target because of the small size of its chromosomes—implying that they contain relatively little junk DNA interspersed with the genes. *Arabidopsis* is also a favorite laboratory organism of geneticists. The existing base of knowledge will enable scientists to capitalize quickly on revelations about the *Arabidopsis* genome.

Piecing together the interlacing roles of the myriad new genes presents a massive puzzle, yet many of the pieces are familiar. By comparing the sequences with those already reported for the mustard and other organisms, the researchers say that they can guess, at least roughly, the biochemical task performed by about 60 percent of the *Arabidopsis* genes.

Even with the detailed role of their genes uncertain, the chromosomes provide biologists with a snapshot of plant evolution. Many genes have similar counterparts on the same chromosome, suggesting that *Arabidopsis* progenitors duplicated them in recent history. An entire quarter of chromosome 2 shows up as a big chunk of chromosome 4. Biologists suspect that gene duplication has been a common route to new traits.



Jennifer Fletcher/USDA

Arabidopsis thaliana.

Gaps exist in both chromosome sequences around the knoblike centromeres. These regions contain repetitious sequences that stymie the techniques that scientists use to break down a genome and then assemble its sequence from small pieces.

The 16 million bases of the long arm of chromosome 2, however, make up one of the longest continuous segments of DNA ever sequenced—second only to a piece of human chromosome 22 unveiled earlier this month. *—O. Baker*

Stents, clot-busters improve survival

To prop open narrowed heart arteries, doctors increasingly are using stainless steel mesh cylinders called stents. When they began employing these permanent inserts routinely several years ago, doctors held out high hopes that the tiny stents could keep blood flowing better than alternative procedures. However, they soon found that stents can jam up with platelets, the blood components responsible for clotting.

Now, researchers report in the Dec. 11 LANCET that the antiplatelet drug abciximab boosts the effectiveness of stents. The results indicate that among heart patients treated with the drug, those receiving a stent are less likely to die during the following year than are patients treated with angioplasty. In that process, a doctor threads a balloon-tipped catheter via blood vessels to a trouble site and opens the vessel by inflating and then removing the balloon.

Researchers tracked 2,399 patients at 63 hospitals in North America for a year after each was treated for moderate heart disease. Of these, 794 received a stent and an infusion of abciximab. Another 809 got a stent and an inert infusion, while 796 others received angioplasty with abciximab but no stent.

Doctors use a catheter to deliver a stent to the narrowed artery. Some patients had to have the artery widened by a balloon first as part of the procedure. All the patients in the study were given heparin and other drugs that inhibit clotting in ways different from how abciximab does it, says study coauthor A. Michael Lincoff, a cardiologist at the Cleveland Clinic Foundation.

After 1 year, only 8 patients given abciximab with a stent had died, compared with 19 of those given a stent without the drug and 17 who received angioplasty and abciximab. Most deaths resulted from cardiac problems.

"These are very exciting results," says cardiologist John A. Bittl of the Ocala (Fla.) Heart Institute. "There's always been this nagging concern that stenting . . . was not associated with long-term benefits for the patient. But now, an agent like abciximab seems to make stenting much safer."

The study also sought to detect heart-muscle damage. When doctors perform angioplasty or insert a stent, fragments of blood clots break up and flow downstream. If these pieces lodge in smaller arteries, more blockages result, damaging heart muscle.

Patients getting a stent with abciximab had significantly less heart damage than the other groups. The combination may work because the stent holds open the narrowed vessel while the abciximab keeps downstream particles from causing more blockages, says E. Magnus Ohman, a cardiologist at Duke University Medical Center in Durham, N.C.

Abciximab binds to a substance called glycoprotein IIb/IIIa, which sits on the surface of platelets. By occupying this molecular site, the drug prevents other platelets from latching on and forming a clot, Lincoff says.

A few years ago, physicians inserting stents administered massive doses of heparin and other blood thinners to prevent blockages, but the drugs caused bleeding internally and at the entry site for the catheter carrying the stent. Abciximab allows doctors to use smaller doses of heparin, easing these problems, Ohman says.

Although abciximab is expensive, patient costs in all three groups were comparable because those receiving the drug with a stent had fewer heart problems over the year. *—N. Seppa*