Biology

Single genes control flower production

Scientists have known that genes, including *leafy* (*LFY*) and *apetala 1* (*AP1*), help determine the development of meristems, the tips of stems where either flowers or shoots for new leaves and stems form. Now, investigators find that *LFY* and *AP1,* each on its own, can trigger flower development.

In the Oct. 12 NATURE, two teams "demonstrate for the first time that expression of single genes is sufficient to confer floral identity" on immature plant parts, George Coupland of Norwich Research Park in England asserts in an accompanying article. Once these genes have flipped the flower-development switch, many other genes get involved in producing flowers.

In mustard plants (*Arabidopsis*) genetically engineered so that the *AP1* stays continuously active, shoots that normally produce stems and leaves form flowers instead, report M. Alejandra Mandel of the University of Arizona in Tucson and Martin F. Yanofsky of the University of California, San Diego.

The genetically altered plants flower in as little as one-third the time it takes normal plants, in part because shoots for stems and leaves form sooner than floral meristems, Yanofsky says.

Other scientists engineered *Arabidopsis* and an aspen tree so that the *LFY* gene stayed active. Those plants also flowered prematurely, report Detlef Weigel of the Salk Institute for Biological Studies in La Jolla, Calif., and Ove Nilsson of the Swedish University of Agricultural Sciences in Umeå. The engineered tree produced flowers in a matter of months, whereas natural aspens take 8 to 20 years.

The findings should make breeding and genetically altering plants and trees easier, the scientists note. However, Coupland warns, transgenic plants often have an unusual form and structure that "might outweigh any advantage caused by improved flowering time."

'Seeds, who needs 'em?' foresters say

Researchers have refined a new technique, which doesn't require seeds, for producing commercial stands of genetically similar hardwood trees, Scott A. Merkle of the University of Georgia in Athens and his colleagues report.

The International Paper Co., which funded Merkle's work, began producing sweetgum trees this year using the new cloning technique. It plans to apply for a patent, Merkle says.

Sweetgum trees are one of the few hardwood species that southern paper companies want to add to their tree plantations, which now consist primarily of pine and Douglas fir, Merkle says. Sweetgums grow in the eastern United States and Mexico.

The cloning procedure involves exposing cells from a group of tightly clustered, male flowers to a commercially available, synthetic hormone that acts as a plant growth regulator. The chemical forces the cells to form embryos instead of flowers, Merkle's team reports. Tree embryos normally grow inside seeds.

When exposed to the regulator, the embryos produced by the flower cells clone themselves, making more embryos. "They get caught in a cycle of continuous embryo production," he says. When removed from the regulator, the embryos grow into normal trees.

Other scientists have used a similar cloning technique to produce a few oak and buckeye trees, which have less commercial value than sweetgum, Merkle says.

International Paper scientists plan to test their sweetgum trees' DNA to see how closely the trees resemble each other. If the offspring prove to be almost identical to their parents, the technique of growing trees from flower tissue should help researchers to preserve rare trees and should aid foresters to produce large numbers of trees with the same desired traits, Merkle says.

Also, cloning trees from tissue should eventually prove quicker and less expensive than previous methods, he contends.

Biomedicine

Cancer and heart risks of dioxins

Several studies have indicated an apparent increased risk of death from cancer among individuals heavily exposed to dioxins and such close chemical cousins as furans (SN: 9/4/93, p.149). A new study now looks at men who worked at a pesticide plant in Hamburg, Germany, at any time between 1952 and the facility's closing in 1984. It shows that a man's exposure to dioxins and furans corresponds to a dose-dependent elevation in his risk of dying not only from cancer but also from heart disease—especially clogged arteries.

Dieter Flesch-Janys of Hamburg's Center for Chemical Workers' Health and his colleagues stratified the 1,189 men using estimates of each worker's exposure. They based those values on how long a man had worked (and where in the plant) and, if available, on recorded body concentrations of TCDD—the most potent dioxin—or its toxic equivalents. They found that plant veterans with the highest exposures faced more than three times the risk of dying from cancer and 2.5 times the risk of dying from ischemic heart disease as workers of similar ages from a nearby gas plant.

"These findings refine the strong existing evidence of a carcinogenic effect of [dioxins and furans] in humans," the researchers conclude in the Dec. 1 AMERICAN JOURNAL OF EPIDEMIOLOGY. The Hamburg team cites three reports that showed hints of a heart disease risk attributable to dioxins. In one of these reports, the investigating epidemiologists had speculated that stress was the likely cause. In their new study, Flesch-Janys and his coworkers note that "there is some evidence from animal models that TCDD may promote atherosclerosis," which "lends credibility to a causal interpretation of our [heart disease] findings."

New support for tea's heart-y benefits

In the generation of heart disease, the oxidative transformation of cholesterol-carrying low-density lipoproteins (LDLs) in the blood leads to the buildup of artery-clogging plaque. Two years ago, Dutch scientists found evidence that tea drinking protects against heart disease, a result they tentatively attributed to the antioxidant properties of pigments and other polyphenols in the brew (SN: 10/30/93, p.278). While not all antioxidants effectively thwart LDL oxidation, researchers at the University of Scranton now show that the polyphenols prevalent in tea do it especially well.

In the just-released November JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY, Joe A. Vinson and his colleagues report that in their test-tube studies of 39 food-derived antioxidants—representing eight classes of chemicals, from vitamins and flavones to anthocyanins—the polyphenols from tea proved the most potent inhibitors of LDL oxidation. Indeed, one tea compound showed 20 times the efficacy of vitamin C, the most potent antioxidant vitamin.

Selenium's role in weight control

Enriching diets with selenium, an antioxidant mineral, may boost weight gain, according to a small study by Wayne C. Hawkes and Nancy L. Keim of the U.S. Department of Agriculture's Agricultural Research Service in San Francisco.

For 4 months, they fed 11 healthy men, age 20 to 45, diets based on ingredients that differed only in selenium content. The diet was tailored to maintain their original weights. The five volunteers assigned to diets providing five times the recommended daily allowance (RDA) of selenium gained about 1.5 pounds during the study. Consuming only about one-fifth of the RDA for selenium, the six other men each lost about 1 pound. Unexpected changes in the body's production of a thyroid hormone known as T3 appear to have altered each group's rate of calorie burning, the researchers conclude.

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