Science Update

Algorithm Helps Hunt Jumping Genes

A new mathematical tool for farm biotechnology may help medical researchers devise gene therapies for people. ARS scientists and a software engineer at Silicon Graphics, in Mountain View, California, devised a new algorithm to scan computer data of genetic code. The algorithm seeks patterns occurring in genetic material associated with jumping genes, or transposons. Transposons will be crucial parts of the architecture of lab-built genes that agricultural researchers plan to insert into potato plants. Their aim: tubers that ward off attacks by bacteria. To give the algorithm a tough challenge, the scientists tested it on a human gene database—far larger than the plant gene database. The algorithm found two transposons that are among the first DNA types of these structures detected in the human genome. Most known human transposons are the RNA, or single-stranded, type. *Teruko Oosumi and William R. Belknap, USDA-ARS Western Regional Research Center, Albany, California; phone (510) 559-6072.*

Fungus Could Make Special Gene Deliveries

A common, soil-dwelling fungus could find a new role as a versatile, lower cost workhorse for biotechnology. ARS scientists have patented their process for using the *Olpidium zoospore* fungus to transport new genes into plants. Some gene-transfer approaches rely on bacteria as gene-toting vectors. These work mostly in the family of plants that includes potatoes, tobacco, and tomatoes. Some other gene-transfer approaches require an expensive tool called a gene gun. But ARS scientists have used *Olpidium* to shuttle new test genes, called "markers," into wheat—an achievement few research teams have managed. The fungus, as a genetic courier, delivers the new genes to plants within an envelope—the harmless outer coat of a plant virus. The scientists say the fungus may prove a useful gene vector for beans, lettuce, and other crops. That's because its natural hosts range widely, from grasses to broadleaf plants. *Lingyu Zhang and William Langenberg, USDA-ARS Wheat, Sorghum, and Forage Research Laboratory, Lincoln, Nebraska; phone (402) 472-3162.*

Algae Show Promise Against Cancer

A blue-green alga rich in beta carotene and other disease-fighting carotenoids may help prevent cancer of the mouth, a study shows. In developing countries, *Spirulina* algae are cheaper than supplements of beta carotene or vitamin A. Other researchers have shown these vitamins to reverse leukoplakia—thick, white, precancerous patches in the mouth. But the new study, coordinated by an ARS scientist, was the first evaluation of *Spirulina's* cancer-preventive potential in humans. After consuming a gram of the algae daily for a year, 45 percent of the study's volunteers had complete regression of leukoplakia. Another 12 percent significantly improved. The study was conducted in southwestern India, which has a high incidence of leukoplakia. Cancer of the mouth and of the cervix, which has the same kind of mucus membrane, is on the rise worldwide. *Padmanabhan P. Nair, USDA-ARS Beltsville Human Nutrition Research Center, Beltsville, Maryland; phone (301) 504-8145.*

Plowing Uproots Carbon

Not all the organic matter lost from cropland soil gets whisked away with soil eroded by storms and wind. Some goes up in puffs of carbon dioxide. Carbon is what makes organic matter organic, so excess carbon loss reduces soil fertility. ARS scientists found the most rapid CO_2 loss within minutes after plowing. The plow mixes soil and crop residue and lets in extra oxygen. This stimulates microbes to chew faster on organic matter—and release more CO_2. The scientists found that carbon losses from wheatfields, during 19 days after fall plowing, were up to five times higher than on unplowed wheatfields. In some cases, soil lost more carbon from plowing than it had gained the previous season from crop residue. Carbon losses varied within short distances and across different soils examined in Minnesota, Texas, and Alabama. ARS scientists are trying to put a dollar value on how the loss of carbon reduces the soil's quality. They want to know if farmers and the environment might benefit, in the long term, from sensors that would direct machinery to till more gently where soil is most vulnerable to carbon loss. *Donald C. Reicosky, USDA-ARS North Central Soil Conservation Research Laboratory, Morris, Minnesota; phone (612) 589-3411.*