biomedical lobbyists hope to keep on a pace to double its budget within 5 years. Last month, Republican leaders put off any votes on the NIH bill until September, partly in hopes that they could broker a deal with the White House to restore the shortfall in NIH's budget. Advocates of breaking the budget caps include Representative John Porter (R–IL), chair of the House appropriations subcommittee that oversees NIH, and Senator Ted Stevens (R–AK), chair of the Senate appropriations committee.

Indeed, Stevens has suggested one possible route out of the impasse: a deal in which the White House agrees to a smaller tax cut bill in return for some surplus funds to raise 2000 budgets. Without a deal, however, "any hope that NIH will keep doubling its budget this year are gone with the wind—we'd be lucky to get a 3% increase," says a Democratic House aide, in contrast to last year's 15% hike. Absence of a budget deal could also imperil efforts to restore funds to NASA and raise NSF's budget by the requested 6%, she says. Ironically, it also undermines the hard-fought House increases in the Pentagon's basic research accounts, which the White House had slated for cuts.

The defense bill is already ensnarled in a debate that could prompt a veto. It centers on a congressional plan to reorganize the Department of Energy's (DOE's) nuclear weapons research program—which is largely funded by the defense bill—into an independent agency within DOE. Energy Secretary Bill Richardson, however, opposes the plan, complaining that it undermines his authority, and has recommended that Clinton veto the entire bill. Richardson supports a different plan passed by the Senate.

Even a smaller tax cut has a downside for science: A proposed 5-year extension of the R&D tax credit, long sought by high-tech and pharmaceutical companies, is currently included in the tax bill. But its cost, estimated at $20 billion, could make it a casualty of this fall's expected political horse trading.

–DAVID MALAKOFF

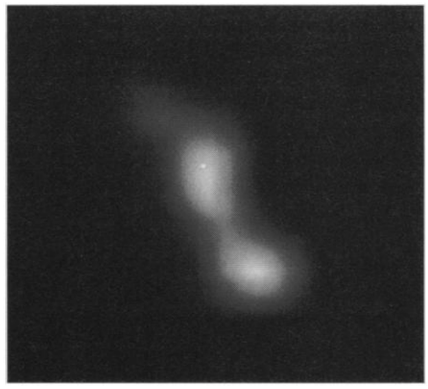
PLANETARY SCIENCE

Deep Space 1 Traces Braille Back to Vesta

Asteroids tend to wander far from home, but researchers can now reunite a wayward offspring with its "parent" in the main asteroid belt between Mars and Jupiter. At a press conference last week at the Jet Propulsion Laboratory (JPL) in Pasadena, California, researchers announced that observations of an asteroid called Braille, returned by the Deep Space 1 spacecraft last week, show that the 2-kilometer-long rock is probably a chip blasted off the 500-kilometer asteroid Vesta, the third largest in the solar system.

Deep Space 1, launched in October 1998, is the first mission in NASA's New Millennium program, set up to test new space technologies. It boasts a xenon-fueled ion propulsion system, high-efficiency solar cells, and an automated navigation system, AutoNav, that enables it to find its way in interplanetary space by tracking stars and asteroids without help from ground controllers. The navigation system brought the spacecraft within 10 to 15 kilometers of the asteroid—the closest flyby ever achieved. The asteroid, discovered in 1992, was only recently named after the Frenchman Louis Braille (1809–1852), who invented the alphabet for the blind. It orbits the sun in an elongated path outside Earth's orbit.

First reports suggested that Deep Space 1's encounter with Braille was a bust, because the spacecraft's camera was pointing into



A lumpy offspring. Two-kilometer asteroid Braille may be a chip off 500-kilometer Vesta.

empty space and missed its target. However, some of the last data beamed back did provide images of a distant, lumpy, elongated body and "colors" of the asteroid in the infrared range. Apparently, Deep Space 1 lost sight of Braille as it approached the asteroid from its dark side, but reacquired its target soon after passing to the asteroid's daylit side, according to mission engineer Marc Rayman of JPL.

Although scientific observations are seen as a mere bonus in the New Millennium Program, team members regretted losing what would have been the closest look at an asteroid so far. But the infrared spectra proved some consolation. Braille's distinctive absorption pattern is "a remarkably close match" both to the asteroid Vesta in the main belt and to a type of meteorite known as a eucrite, said team member Laurence Soderblom of the U.S. Geological Survey in Flagstaff, Arizona. The close resemblance of eucrite spectra to that of Vesta had persuaded most astronomers and meteoriticists that eucrite meteorites come from Vesta, the only strong meteorite-asteroid link

CREDIT: (TOP TO BOTTOM) ISRAELI KNESSET; JPL/NASA

ScienceScope

New Face in Israel A career army officer–turned-politician is Israel's new science minister. Recently elected Prime Minister Ehud Barak last week appointed Matan Vilna'i (right) to oversee the nation's new Ministry of Science, Culture, and Sport.

Scientists are waiting to see whether Vilna'i can protect a drooping $50 million science budget from further cuts. He told *Science* he would "do everything needed to invest in and develop science" after being sworn in on 6 August—words welcomed by Israel Hanukoglu, a molecular biologist at the College of Judea and Samaria, who served as science adviser to former Prime Minister Benjamin Netanyahu. Vilna'i appears "committed to strongly supporting science," Hanukoglu says.

Vilna'i, 55, has vowed not to let science play second fiddle to soccer within his newly amalgamated ministry. But if nothing else, quips one researcher, "maybe science will become the national sport."

No Class Rings? Biomedical teaching powerhouses of the world relax: The National Institutes of Health (NIH) won't be muscling onto your turf after all. NIH officials last month quietly abandoned controversial plans to create a doctoral program on the NIH campus in Bethesda, Maryland.

NIH had planned to seek Congress's permission to admit about 15 students a year to a 5-year program in "disease-oriented integrative biology." But in June, three members of an influential NIH advisory panel came out against the plan, noting that U.S. universities are already under fire for producing too many biologists (*Science*, 11 June, p. 1743). The row prompted NIH director Harold Varmus and deputy director for intramural research Michael Gottesman to give up the idea. "This was obviously beginning to be a source of irritation," says Gottesman.

Instead, the pair will focus on expanding programs that allow grad students to earn credit for work done at NIH. The agency already has such partnerships with the University of Maryland and Duke, George Washington, and Johns Hopkins universities.

anyone has been able to make. Now asteroid Braille looks to be a bigger chip off Vesta.

Given the match with Vesta, planetary scientists have a plausible story of how Braille, as well as eucrite meteorites, were born. As impact specialist Eileen Ryan of New Mexico Highlands University in Las Vegas, New Mexico, explained, Braille and the eucrites could have been blasted off Vesta in the huge impact that left a 460-kilometer crater, which is visible in Hubble Space Telescope images of the asteroid. The likely debris can be seen as small, Vesta-colored asteroids near their parent and strewn across the asteroid belt to a point where Jupiter's gravity could fling it in toward Earth. Braille hasn't yet gotten as far as the eucrites, but Soderblom noted that it will be drifting across Earth's path in the next few thousand years, possibly making it the planet's "Y6K" problem. –RICHARD A. KERR

BIOTECHNOLOGY

New Genes Boost Rice Nutrients

ST. LOUIS—The latest high-tech version of rice may look like the saffron rice of paella, but the pretty yellow color is far more than decoration. Described here last week at the 16th International Botanical Congress, the golden rice has been genetically engineered to contain β-carotene, the precursor to vitamin A, as well as a healthy dose of iron. This achievement, by plant molecular biologist Ingo Potrykus at the Swiss Federal Institute of Technology in Zurich and his colleagues, is not only a Herculean feat of gene transfer, but also a major leap on a more humanitarian front: It may offer improved nutrition for the billions of people in developing nations who depend on rice as a staple food.

Many researchers have already slipped one or two foreign genes into everything from tomatoes to cotton, endowing them with traits such as resistance to herbicides, plant pests, or pathogens. But the rice strain created by the Potrykus team carries a total of seven foreign genes from two separate pathways: Four encode enzymes that give rice grains the ability to make β-carotene, and three more allow the kernels to accumulate extra iron in a form that the human body can better absorb. Gene transfer on this scale, says plant biochemist Dean DellaPenna at the University of Nevada, Reno, "is tremendously exciting and should have an enormous impact."

"This is the first kind of rice that is genetically engineered for nutritional enhancement," adds Gurdev Khush, principal plant breeder at the International Rice Research Institute (IRRI) in Manila, Philippines, and the humanitarian payoff could be high. Vitamin A deficiency affects some 400 million people worldwide, leaving them vulnerable to infections and blindness. And iron deficiency—the number one micronutritional shortage, which a diet of rice can exacerbate—afflicts up to 3.7 billion people, particularly women, leaving them weakened by anemia and susceptible to complications during childbirth. In addition, because the endeavor was not industry-funded, Khush and Potrykus both point out, the poor farmers who most need the micronutrient-rich rice are likely to get it, free of charge.

The roots of the project go back 7 years, when Peter Burkhardt in Potrykus's laboratory took on the daunting task of inducing rice to make β-carotene, which the body readily converts to actual vitamin A. Although rice kernels contain absolutely no β-carotene, they do make a molecule called geranylgeranyl pyrophosphate that can be converted to β-carotene by a sequence of four enzymes in the vitamin A pathway. The Swiss researchers had access to the genes for those enzymes, cloned from daffodils by Peter Beyer at the University of Freiburg in Germany. The problem would be getting all four genes into the rice kernel and working in sync.

In the first stage of the work, Burkhardt attached the genes to regulatory sequences that would allow them to be turned on in rice kernels. But when he tried to shoot the four modified genes into rice plant cells with a "gene gun," a standard way of introducing new genes into plants, he couldn't get all four to work properly: Most shut down after settling into the rice genome. The team didn't succeed until graduate student Xudong Ye entered the lab and tried new strategies.

Golden grains. The yellow color of this genetically modified rice is due to its ability to make β-carotene.

CREDIT: I. POTRYKUS AND P. BEYER

Ye switched the source of two of the four genes from daffodil to the bacterium *Erwinia uredovora* and used the plant-infecting microbe *Agrobacterium tumefaciens* to ferry in the genes. When *Agrobacterium* infects plants, it injects them with a circular piece of DNA called a plasmid. Ye put the two daffodil genes on the plasmid of one *A. tumefaciens* strain and the *Erwinia* genes on the plasmid of another, and then let the bacteria do the job of introducing the genes into plant cells. The strategy worked, yielding plants that produced rice grains literally golden with β-carotene.

Meanwhile, Potrykus and graduate student Paolo Lucca were working on the iron supplementation project, which involved introducing three genes into rice plants. One was aimed at doing away with a molecule in rice that makes people on a high-rice diet prone to iron deficiency. Called phytate, this sugarlike molecule ties up 95% of dietary iron and so keeps the human body from absorbing it. The Swiss pharmaceutical giant Hoffmann-La Roche in Basel provided a fungal gene for an enzyme known as phytase, which breaks down phytate. Whereas most enzymes unfold and lose their activity when heated, the Hoffmann-La Roche enzyme carries a mutation so that it can withstand cooking temperatures. One of the other two genes introduced by Lucca comes from the French bean and encodes the iron-storage protein ferritin, which doubles iron levels in the rice grains. And the third gene, from basmati rice, makes a metallothionein-like protein, which is rich in cysteine, a sulfur-rich amino acid that helps in iron absorption in the human digestive system.

In the final step of their 7-year odyssey, the Potrykus team crossbred their β-carotene– and iron-rich rice strains, producing hybrids that combined both improvements. As little as 300 grams of the cooked rice per day—a typical Asian diet—should provide almost the entire daily vitamin A requirement, Potrykus says. In addition, the experimental rice appears to be fertile and to grow normally in greenhouses. The success so far doesn't mean that the new crop is ready for market, however. Potrykus and his colleagues used the lab workhorse japonica strain of rice for their experiments, while indica rice is the most common commercial strain. So scientists at IRRI will now take on the task of crossbreeding the new strain with indica rice and field-testing the hybrids. If all goes well, Khush estimates, the golden rice could land in the fields of developing countries in 2 to 3 years—assuming, that is, that it doesn't meet with regulatory barriers such as those imposed by Britain, which currently has issued a moratorium on all genetically altered foods.

Khush and Potrykus think that won't happen. Because the potential benefits seem great and the potential health and environ-