mental risks small, the two researchers say, the new rice strain may draw less opposition from the critics of genetically engineered foods than other modified crop plants now being marketed (*Science*, 28 May, p. 1442). DellaPenna hopes they are right. These results, he says, "are wonderful and what needs to be done." **–TRISHA GURA**

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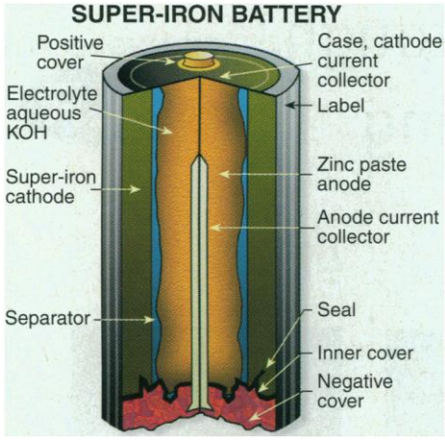
ELECTROCHEMISTRY

"Super-Iron" Comes to The Rescue of Batteries

Georges Leclanché, the French chemist who developed the dry battery nearly 140 years ago, would probably recognize the basic elements of a flashlight battery today. Most such batteries still contain a zinc anode and a cathode made of a mixture of carbon and manganese dioxide. But now a team led by Stuart Licht at the Israel Institute of Technology, or Technion, in Haifa reports on page 1039 the development of a



Charge it. It looks like a regular battery, but the difference is in the cathode.

new class of batteries that have greater capacity, a faster discharge rate, and are rechargeable. The difference is in the cathode, which is made from unusual iron-based molecules known as iron(VI), or "super-iron," compounds that absorb more electrons than manganese dioxide. "Their performance in a battery system is very astounding," says Jeff Dahn of Dalhousie University in Halifax, Canada.

When a battery discharges, electrons absorbed from the electrolyte by the zinc anode pass through an electric circuit and end up in the cathode, where two manganese dioxide (MnO_2) molecules join to form a manganese sesquioxide (Mn_2O_3) molecule, absorbing two electrons in the process. In the new super-iron compounds—which contain oxygen, as well as potassium, barium, and other elements—each iron atom is missing six electrons. During discharge, the iron is converted into a form of ferric oxide (Fe_2O_3)—common rust—that is three electrons short of its normal complement. Each iron atom thus absorbs three electrons, one more than two manganese dioxide molecules absorb.

This larger appetite for electrons translates directly into increased storage capacity. The Technion team has produced batteries with super-iron cathodes that have capacities up to 47% greater than standard manganese dioxide batteries of the same size. They also found that the batteries' performance at high discharge rates was better because super-iron compounds are also better conductors of electricity. Another advantage is rechargeability: The team reports some 400 charge-discharge cycles.

The team searched a long time before settling on super-iron compounds. "Previously we looked at sulfur, hydrogen peroxide, and a variety of materials, each of which have very unusual electrochemical properties, but were not compatible with the existing systems," says Licht. Some other possible compounds were also ruled out because "we specifically wanted to start with an [environmentally] 'clean' material," says Licht. The rust generated by discharging this battery is preferable to the somewhat poisonous manganese compounds that remain in the batteries presently used, notes Licht.

Even so, super-iron compounds were not an obvious choice, because they are considered too unstable. "When these [compounds] were made in the past and you put them in a solution, they disappeared within minutes, decomposing into rust," says Licht. The team solved this problem by carefully eliminating two catalysts, nickel and cobalt, that usually contaminate these compounds. The researchers found that, even in very small quantities, they cause the super-irons to break down. "We have demonstrated lifetimes of the super-irons without any change on the order of a month and extrapolated lifetimes of years," says Licht. Denis Dees of Argonne National Laboratory in Illinois says, however, that he would like to see evidence that such batteries can survive for 6 to 12 months on the shelf and still be discharged. Because of the questionable stability of iron(VI) compounds, he says, "it is interesting that they have made it work at all."

If the cathodes do prove durable, Licht says the batteries should not be difficult to make. "We have been able to take it from a concept very quickly to conventional-sized batteries, and that is very promising," he says. Another plus is that the starting materials are inexpensive and more easily available than manganese compounds. **–ALEXANDER HELLEMANS**

Alexander Hellemans is a writer in Naples, Italy.

CREDIT: (LEFT) LICHT *ET AL.*

ScienceScope

India's Science Summit Indian scientists want their government to create a pair of autonomous commissions that would help improve the country's performance in biotechnology and sustainable technologies. The recommendation, made last week by more than 150 researchers attending the first National Science Summit in Bangalore, aims to build on the success of panels that have channeled new resources into space and nuclear power.

The summiteers, gathered by the nonprofit education group Bhartiya Vidya Bhawan, also took stock of India's science record. Although many cheered advances in space research, agriculture, and other areas, others worried that success remains uneven. "There are icebergs of good science floating in a sea of bad," said biophysicist Padmanabhan Balaram of the Indian Institute of Science in Bangalore and editor of *Current Science*, a leading journal.

It's too soon to know whether the proposed panels will ever set sail. The politicians who would have to approve them are in the thick of an election campaign that ends in October.

Science Succession Democrats have a new leader on the House Science Committee. As expected, Rep. Ralph Hall (below) of Texas last week officially inherited the leadership slot left open by last month's death of Rep. George Brown (*Science*, 23 July, p. 509).

Hill watchers don't expect any immediate changes in the committee's slant under Hall, who will lead the 22 Democrats serving on the 47-member panel. But the Texan—who has served on the committee for almost 2 decades and is a former head of its space subcommittee—is far more conservative than his predecessor, often voting with Republicans on fiscal and social matters. Although that history may smooth relations with feisty panel head James Sensenbrenner (R–WI), House aides say it is unclear what it means for science policy. Says one: "He is further right, but those partisan labels often don't mean much in science politics."

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