

David Umberger/Purdue News Service

*Purdue researchers demonstrate their method for producing hydrogen by adding water to an alloy of aluminum and gallium. The hydrogen could then be used to run an internal combustion engine. At center is Jerry Woodall, a distinguished professor of electrical and computer engineering, with doctoral students Charles Allen (holding test tube), and Jeffrey Ziebarth.*

### **WITH ALUMINUM AND NUCLEAR POWER, WATER CAN REPLACE GASOLINE**

A Purdue University engineer has developed an ingenious method of generating hydrogen at the point of use for internal combustion engines. The low-temperature process uses a liquid alloy of aluminum pellets dissolved in gallium. When water is added, it is spontaneously cleaved, releasing hydrogen while the oxygen binds to the aluminum, forming aluminum oxide. Nuclear power would be used to reconvert the aluminum oxide. Jerry Woodall originally discovered the reaction while working in the semiconductor industry in 1967.

The hydrogen could be used as generated in internal combustion engines (at 25 percent efficiency) or in future fuel cell engines (at 75 percent efficiency). The high cost of aluminum, now over \$1 per pound, is the main constraint to the process becoming competitive with gasoline. Woodall calculates that the process would be competitive if electricity from a dedicated nuclear power plant were used to regenerate the aluminum through fused salt electrolysis. "A midsize car with a full tank of aluminum-gallium pellets, which amounts to about 350 pounds of aluminum, could take a 350-mile trip and it would cost \$60, assuming the alumina is converted back to aluminum on-site at a nuclear power plant," Woodall said at a press conference on May 15. The gallium, though expensive, is not used up in the process. Woodall pointed out that if fuel cells become available, the high efficiency of the hydrogen reaction would make it competitive even without such aluminum recycling.

This technology gets around two problems in using hydrogen for transportation fuel: No hydrogen need be stored in the vehicle, and no hydrogen need be piped to, or stored at, fueling locations. The end product of the hydrogen combustion in the auto is simply water.

### **SIBERIA: SLEEPING RESOURCE GIANT ABOUT TO AWAKEN**

"We've got rich reserves of just about the whole periodic table," Alexander Khloponin, governor of Siberia's Krasnoyarsk region, stated. In what some are calling the "new industrialization," Khloponin told a conference in Krasnoyarsk in February that more than 300 investment projects totaling \$400 billion were planned for Russia by 2015-2020—two-thirds of it destined for east of the Urals. But the ability to realize these depends on state investment in infrastructure. Khloponin warned that those projects could not succeed without massive state infrastructure investment—in road and rail links, airports, housing, services—estimated at \$150 billion. These are vital, Khloponin said, to attract new settlers and reverse a declining Siberian population.

### **CHINA TO HAVE WORLD'S MOST ADVANCED NUCLEAR FUSION TEST REACTOR**

China's Institute of Plasma Physics in Hefei is doubling its capabilities to carry out its "artificial Sun" nuclear fusion program, and plans to spend \$30 million for a new heating system and other technologies, Institute deputy director Song Tao Wu told a group of visiting foreign journalists in May.

In addition to its Russian-designed HT-7 tokamak, China has designed and built the Experimental Advanced Superconducting Tokamak (EAST), now the world's most advanced fusion device, and the first to have superconducting magnets for plasma confinement. EAST will be a testbed for technologies proposed for the International Thermonuclear Experimental Reactor (ITER) project, now under construction in Cadarache, France. ITER is a collaborative effort of the European Union, the United States, Japan, Russia, India, South Korea and China, and is scheduled for operation by 2016. China has pledged to meet 10 percent of the ITER budget, and will send 30 fusion scientists to it.

China, which has been working on thermonuclear fusion for 50 years, is also collaborating with the San Diego-based company General Atomics, which in February carried out a plasma discharge experiment on the EAST, working remotely. General Atomics has the largest privately operated U.S. tokamak, the Doublet III.



Institute of Plasma Physics, Chinese Academy of Sciences

*China's EAST tokamak, the first to use superconducting magnets, which enable it to confine the fusion plasma for a longer period of time.*

### WILL BRAZIL GIVE ANGRA 3 NUCLEAR REACTOR A GREEN LIGHT?

Plans for Angra 3, Brazil's third nuclear reactor, could be approved at a meeting of the National Energy Policy Council in June, and Odair Goncalves, head of the government's nuclear energy commission, is confident that the plant will get the go-ahead despite opposition from Environment Minister Marina da Silva. Angra 3 was originally planned as a twin unit to Angra 2, a 1,270-megawatt-electric pressurized water reactor, which started up in 2000. Parts for the reactor had been purchased before the project was frozen because of a lack of funds, and more than 70 percent of the equipment is already on site. It is estimated that the project will cost \$3.5 billion to complete, *World Nuclear News* reported May 18.

The two operating nuclear power units at Angra have a combined generating capacity of 1,896 megawatts and provide about 3 percent of Brazil's electricity. Brazil has its own uranium resources and has been mining uranium for use in Brazil's power plants since 1982. The Brazilian government has planned for the construction of up to eight new nuclear power plants by 2030.

There is growing evidence of collaboration on nuclear energy among Brazil, India, and South Africa. President Lula da Silva will be in India in early June, and a discussion on commercial nuclear collaboration is on the agenda.

### ANTIBODIES FROM SURVIVORS COULD SAVE LIVES OF BIRD FLU VICTIMS

A study published in the May *Public Library of Science (PLoS) Medicine* journal, has proven the benefit of an old technique for a new disease. The authors utilized neutralizing antibodies taken from convalescent victims of the H5N1 avian flu, and, using new biotechnologies, created an immortal human B cell line which would churn out just the desired antibody. Antibodies from four separate patients in Vietnam were tested for their ability to neutralize H5N1 virus both *in vitro* and *in vivo* using a mouse model.

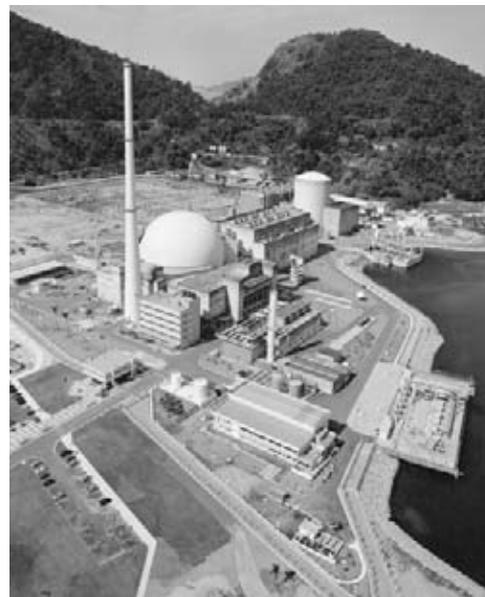
Because it would take months to gear up, produce, and distribute an effective bird flu vaccine, were a pandemic to arise, the ability to extract and produce effective antibody preparations from local survivors, which could be injected into local victims, would be a valuable adjunct to anti-virals and pre-pandemic vaccines.

The authors chose several efficacious antibody preparations, and tested them in mice infected with either the same strain of virus that infected the antibody donors, or a different strain from Indonesia. All the antibodies were capable of protecting mice with the bird flu, if given just before, or within three days after the mice were infected. Some of the preparations even showed cross immunity for the different strain of H5N1.

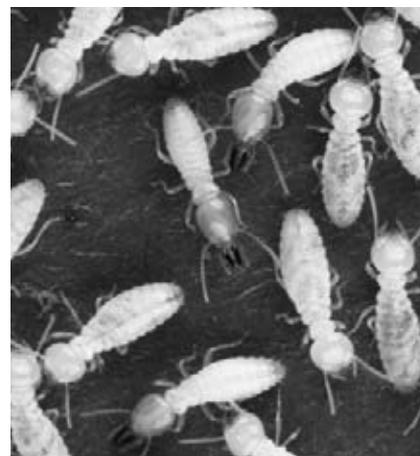
The authors cite an interesting review from the *Annals of Internal Medicine* (Oct. 2006) showing that, during the 1918 Spanish influenza pandemic, many hospitals were using blood products from flu survivors, and injecting them into severely ill patients. The review study concluded that such practices cut mortality rate by perhaps 50 percent where used.

### LET THEM EAT BUGS!

Dr. Monica Ayieko of Maseno University in Kenya thinks she has the answer to starvation and malnutrition in Africa, and if she has her way, women of rural Africa will soon be adding yet another task to their never-ending work: gathering bugs to supplement the family meal. Termites and mayflies are plentiful, even during drought, she claims, and they are full of protein, fatty acids, and vitamins. They could be a valuable supplement to the starchy staples, corn and cassava. She even foresees a cottage industry for rural women trading in bugs.



*The Angra nuclear power site, with Angra 2 in the foreground. Will it have a twin?*



USDA

*Gathering bugs is fine for chimpanzees, but what Africa's young people really need is education, so they can dream of travelling to Mars, instead of to the next termite mound.*