

Brewbaker, the governor's education liaison, says that this was simply a joke, and that the governor supported the textbook insert as a compromise.

Alabama's official curriculum guide for teachers of kindergarten through grade 12 science was also fitted with anti-evolution language: "Explanations for the origin of life and major groups of plants and animals, including humans, shall be treated as theory and not as fact." And in March, Governor James used taxpayers' money in a discretionary fund to send every high

school biology teacher in Alabama a copy of an anti-evolution book, *Darwin on Trial*, by Phillip Johnson. The idea was to "give teachers a resource" in case students asked about the textbook insert, says Brewbaker. In response, NCSE, the National Association of Biology Teachers, and People for the American Way sent a countermailing that includes a critical review of the book.

Darwin on Trial echoes what many Americans, apparently including Justice Scalia, believe: that there is serious debate among scientists about whether evolution is a fact. "The nontechnical population believes this, and we have to get over that misunderstanding," says paleontologist David Schwimmer of Columbus State University in Georgia. The results of a recent NSF study, "Science and Engineering Indicators 1996," prove his point. Only 2% of those surveyed understood science as the development and testing of theory, and only 44% agreed with the statement, "Human beings, as we know them today, developed from earlier species of animals." Indeed, this rejection of evolution spotlights the failure of scientists to effectively communicate with the public, says evolutionary biologist Francisco Ayala of the University of California, Irvine. "We are doing a miserable job in our schools and in educating the public at large," he says.

Ayala has formed a committee to discuss how to update the NAS's 1984 booklet, "Science and Creationism," and whether the academy should provide additional support for teachers; recommendations to the NAS Council are expected in early August. Committee member Joseph McNerney, director of the nonprofit Biological Sciences Curriculum Study in Colorado Springs, Colorado, is pushing for the NAS to take an activist role

AN EVOLVING ISSUE

Year	Decision/Action
1925	The state of Tennessee convicts John T. Scopes of the crime of teaching evolution.
1968	In <i>Epperson v. Arkansas</i> , Supreme Court rules that states cannot ban the teaching of evolution on religious grounds.
1982	Federal district court rules in <i>McLean v. Arkansas Board of Education</i> that "creation science" is in fact religion.
1987	In <i>Edwards v. Aguillard</i> , the Supreme Court reaffirms 1982 decision. But dissenting opinion raises idea of "evidence against evolution."
1995	Alabama Board of Education adopts anti-evolution textbook insert.
Feb. 1996	Georgia creationists add an anti-evolution paragraph to an education bill, which is later voted down.
March 1996	Tennessee Senate debates and votes down bill allowing teachers to be dismissed for teaching evolution as fact.
March 1996	Ohio House committee holds hearings, votes down bill requiring that evidence against evolution be taught.
April 1997	Texas State Board of Education will begin reviewing biology textbooks for 1998 adoption.

by presenting new fossil and molecular evidence and promoting classroom activities teachers can use. "It's critical to have the academy involved," he says. "Scientists have to keep responding on this issue."

But just how to respond is a tricky matter. The NCSE's Scott discourages individual scientists from debating creationists, and those who have done it say she's right. East Tennessee State's Shanks, for example, took on ICR's Duane Gish in April before an audience of 1200. Shanks spent 15 to 20 hours

per week for 5 months studying creationist arguments—"reading the most stupendous rubbish imaginable," he says—and examining tapes and transcripts of other debates. Although he made a good showing, Shanks says he left the 4-hour event feeling like he'd been in a boxing match. "All too often a hapless scientist goes before a crowd that has little scientific understanding, and the creationist comes out looking good," he warns.

Still, scientists can probably make a difference by being active in their school districts and states, says Scott. She says that the "evidence against evolution" strategy pushed at the state level has only just begun to metastasize to lower levels—where it has the best chance of success. Indeed, back in Ohio, biologist Edinger is keeping his ear to the ground for more anti-evolution rumblings and worries that the dead bill may soon be resurrected in a slightly different form, probably in local school-district policies. "My worry is that we're going to have to fight this school district by school district," he says—a daunting prospect, considering the effort it took to defeat the state bill. He and others vow to continue the fight by speaking out at hearings, maintaining an e-mail network, and coordinating with national groups. Creationist tactics may be shifting, but scientists' strategies are evolving too.

—Karen Schmidt

Karen Schmidt is a science writer in Greenville, North Carolina.

FUSION

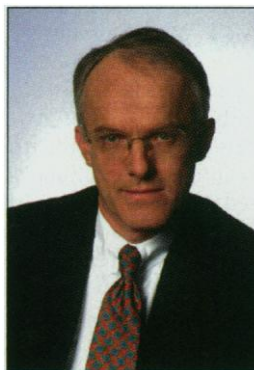
France, Germany Drop Out of ITER Race

The list of countries willing to host a multi-billion-dollar fusion facility got much shorter last week when France and Germany effectively took themselves out of the competition.

The surprise announcement by the research ministers of both countries sent jitters through the international fusion community and makes Japan the odds-on favorite as the site for the International Thermonuclear Experimental Reactor (ITER)—if it is built.

Europe, Japan, Russia, and the United States have been working since 1992 on a design for ITER, with joint research efforts under way in Germany, Japan, and the United States. Construction is scheduled to begin in late 1998 on a tokamak-shaped containment vessel that would demonstrate the feasibility of creating large amounts of electrical power

with a fusion reactor. It would be the largest and most sophisticated fusion machine ever built, drawing researchers from around the world.



No thanks. Rüttgers says Germany can't afford to host ITER.

Six nations were originally in the running as host for the reactor. The catch is that the host country must pick up the biggest single share of the costs, which are expected to top \$8 billion during a decade of construction. Russia and the United States have already scaled back their participation in the design phase, and neither is expected to be a major player in building and operating the test reactor (*Science*, 19 January, p. 282). Sweden and Italy are the remaining European contenders for a site, although European officials say it is highly unlikely that either country could afford the honor. A private Canadian group

is touting two potential sites, but there is little government support for the effort.

That leaves Japan, which is mulling over three potential sites and where industry and government backing of the project is strong. On 8 July, an editorial in the English-language *Japan Times* made the case boldly. "This time it is Japan's turn," wrote Kazuo Nukazawa, executive counselor of the Keidanren, a federation of the country's most powerful companies. "The time has come for cutting-edge international scientific research to be conducted in Asia. ... ITER should come to Japan." Officials familiar with the Japanese effort say that the government and industry are willing to foot at least 70% of the bill.

That scenario appears increasingly likely after Jürgen Rüttgers, the German research minister, and his French counterpart, François d'Aubert, announced last week that neither nation will host the facility if the host must pay 70% of the costs. The ministers emphasized that they will maintain their role in ITER's design phase and continue with their domestic programs, however. The 17 July communiqué followed a visit by Rüttgers to the French capital.

"It's clear that this is a German initiative," says Ernesto Canobbio, international relations adviser for fusion at the European Commission. "Rüttgers ... has coerced France into this," he added. European officials say that the Commissariat à l'Énergie Atomique, which is responsible for the French fusion program, was unaware of the decision. "This comes as a surprise, although it has been evident for a while that Europe would not host a site at a funding level of 70%, or even 50%," adds Ronald Parker, a manager at the ITER design site in Garching, Germany.

The announcement also came as an unpleasant shock to ITER director Robert Aymar, who disputed the size of the financial load on the host country. "There is a misunderstanding among a lot of people," says Aymar, a French physicist and former chief of the Institute of Fundamental Research in Paris. "The 70% figure has never been discussed officially." The ITER partners have talked about the host putting up 30% of the costs, he said, including the buildings, wiring, piping, and some large items not easily transported, "but the remainder could be shared" by the nonhost nations. "Even the 30% could be split."

Aymar pointed out that the French-German statement does not rule out either country hosting ITER if the tab for that honor is less than 70% of the costs. However, the shrinking number of major partners will inevitably raise the overall cost of ITER to the host country. "The only possible solution now is a host country who takes care of the largest part," says Canobbio. "It has to be more than 50%.

You can't build ITER in Japan, with Europe paying half, or the other way around."

The timing of the French-German decision is particularly awkward for the ITER council, made up of representatives of the partners. The council meets this week in St. Petersburg to approve a report on the project's future and begin work on how to structure a partnership during the construction and operation phase. That effort would last until

July 1997, Aymar says, when formal negotiations are scheduled to begin. Only then will specific responsibilities be set, he adds. For ITER's European backers, the challenge is to maintain enthusiasm for a project that appears increasingly likely to bear a stamp marked Made in Japan.

—Andrew Lawler

With reporting by Alexander Hellemans in Brussels.

AGRI BIOTECHNOLOGY

Pests Overwhelm Bt Cotton Crop

One of the first large-scale plantings of a transgenic crop isn't working out quite the way its developer, Monsanto Co., had hoped. Thousands of acres of cotton bioengineered to make its own insecticide have fallen victim to cotton bollworms, one of three pests that the crops were supposed to kill. In addition to coming as a rude surprise to farmers who must buy and apply pesticides after planting the premium-priced seeds, the result has heightened the fears of environmental activists that the insects will eventually develop resistance to the toxin, known as Bt—and that fear has revived calls for tougher federal biosafety regulations. The news triggered a 1-day, 18.5% drop in the stock price of the company that markets the seeds, Delta and Pine Land Co., and the reasons behind the disappointing results serve as a reminder to researchers that Mother Nature still has a few tricks up her sleeve. "It's taken a little bit of the glow off this stuff," says Fred Gould, an entomologist at North Carolina State University.

So far, the problem affects only a small portion of the 2 million acres planted this year with Monsanto's Bt cotton seed, which contains genes from the bacterium *Bacillus thuringiensis* (Bt). Bt toxin is harmless to humans, but it kills three pests that attack cotton—cotton bollworm, pink bollworm, and tobacco budworm. Early last week, Monsanto announced that up to 20,000 acres of Bt cotton were failing in eastern Texas. Monsanto has since advised farmers from Oklahoma to Georgia to be ready to spray because of infestations of bollworms.

Monsanto emphasizes that the Bt cotton—about 13% of the total U.S. cotton crop—had been working well against bollworms until their numbers recently shot up. The company's chief scientist for Bt cotton, Randy Deaton, says the increase may be the result of unusually hot weather and the fact that more Southern farmers planted corn—a breeding ground for bollworms—this year to take advantage of high corn prices. With such high densities, even a survival rate of 5% to 10% means a lot of hungry bollworms. Given those numbers, says Gould, "no entomologist was really surprised" by the Bt cotton failure.

What is worrying some scientists, however,

is that such failures will speed up the evolution of pests resistant to Bt. That threatens the viability of not only Bt plants but also Bt sprays, which are used by organic farmers; resistance could develop much faster with plants than with sprays because the plants produce toxin continuously. Last week the Union of Concerned Scientists asked the Environmental Protection Agency (EPA), which requires resistance-management plans, to suspend Monsanto's registration for Bt cotton.

The union's Margaret Mellon says the problem is that the Bt cotton isn't producing enough toxin to kill most of the bollworms, so many insects with resistance will survive. But Deaton says that there is disagreement on whether high doses are needed to guard against resistance, and whether sufficient precautions are being taken. The company is relying on "refugia"—nearby plants that don't contain Bt toxins—to sustain pest populations that can mate with and dominate the genes of any resistant insects. EPA Assistant Administrator Lynn Goldman says the agency won't make any decision until it has received information on whether the cotton is adequately expressing the protein and whether any insects appear to be developing resistance.

Gould says that the use of refugia should prevent resistance from developing in a single season, but he believes EPA should consider requiring larger refugia within fields. He says EPA may also need to consider what will happen when Bt crops that kill bollworms are planted side by side, as could happen next year when Monsanto plans to begin marketing Bt corn. Other scientists want EPA to enlist the help of outside experts. "I'm sympathetic with companies wanting to get their money [investment] back," says William McGaughey, a geneticist with the U.S. Department of Agriculture in Manhattan, Kansas. "But a little more knowledge would be useful, too."

In the end, the market may be the final arbiter of Bt cotton. "When it all settles down, [growers] will still think this is a good technology," predicts Ray Young, an agricultural consultant in Mississippi. "But it may not be worth as much as [Monsanto] is pricing it at."

—Jocelyn Kaiser