self." Chapela and Quist did not report performing such additional tests.

Motivated by these sorts of concerns, at least four groups of researchers—from the University of Washington, the University of Georgia, and two from Quist and Chapela's home base of UC Berkeley—sent sharply critical letters to *Nature* in December. Three referees reviewed the letters and recommended publication of one or more, accompanied by a rebuttal from Quist and Chapela. "The PCR and iPCR [inverse PCR, a variant] data presented is simply not sufficient data to warrant ANY of the conclusions of the authors," including both the presence of transgenic DNA in Mexican maize and its instability, declared the first reviewer. "*Nature* should demand that the authors retract their manuscript if they cannot demonstrate well-controlled DNA blot analyses [a common confirmatory test] documenting transgene integration events."

"*Nature* is coming under pressure to use secondary technical criticisms to discredit our main findings," responds Quist. Regarding doubts about the instability he reported, he believes that "the critique is coming from expectations" created by lab experiments "that aren't necessarily reflected in what you see when you go out in nature." To respond to criticisms, "we're discussing with *Nature* the possibility of publishing [in a reply] some new information that substantiates our findings."

(*Science* obtained three of the letters, the initial Quist-Chapela response, and some of the anonymous referee reports from sources other than their authors, who are blocked by *Nature* from discussing their critiques before publication. *Nature* editor Philip Campbell says the journal acts "as promptly as possible" on criticisms, publishing them when "appropriate.")

Surprisingly, even Quist and Chapela's most strident critics agree with one of their central points: Illicit transgenic maize may well be growing in Mexico. In May 2001 Chapela shared his initial results with the National Institute of Ecology (INE, the research arm of the Mexican Ministry of the Environment and Natural Resources) and the interagency National Biodiversity Council (CONABIO). Concerned, INE and CONABIO took maize samples from 20 random locations in Oaxaca and two in the adjacent state of Puebla. The samples were divided into two groups and independently analyzed by researchers at the National Autonomous University of Mexico and the Center for Investigation and Advanced Studies (CINVESTAV) at the National Polytechnic Institute. At a 23 January meeting in Mexico City, CINVESTAV official Elleli Huerta presented preliminary PCR findings indicating that transgenic promoters, mostly CaMV 35S, were present in about 12% of the plants. In some areas, up to 35.8% of the grain contained foreign sequences, INE scientific adviser Sol Ortiz Garcia told *Science* last week.

According to Ortiz, both the INE lab and the National Autonomous University of Mexico labs are still "double-checking" the findings. The possible corroboration, Alvarez-Buylla Roces says, is "only based on PCR tests and [is] preliminary." Indeed, says Timothy Reeves, director-general of CIMMYT, which is working with the Mexican government, the two Mexican teams are now responding to the criticism of PCR methodology by revamping their analyses to include bigger samples and more reliable tests.

Meanwhile, CIMMYT, which develops improved crops for Third World farmers, has been searching its vast storehouse of maize varieties for transgenic "contamination." By 22 February, the lab had found none, and the organization has adopted measures that it believes will prevent GM maize from entering its gene bank, preserving at least some of Mexico's maize diversity. But given the amount of transgenic maize in the United States, Reeves believes it is "very likely" that some will eventually end up growing in Mexico. For now, however, "transgenic maize in Mexico is still hypothetical."

—CHARLES C. MANN

AGRICULTURAL BIOTECH

NAS Asks for More Scrutiny of GM Crops

The U.S. Department of Agriculture (USDA) needs to strengthen its procedures for approving field tests and commercialization of transgenic plants, a National Research Council committee concluded in a report released last week. Although transgenic crops don't pose a greater risk than that of products of conventional breeding, the committee said, traits introduced by either technique can pose risks to the environment. Ultimately, it added, the potential environmental impact of conventionally bred crops should also be assessed. But for now, to bolster its regulation

CREDIT: KEITH WELLER/USDA

Look closely. An NRC panel says USDA should regulate biotech crops more rigorously.

ScienceScope

Debate Down Under Australian researchers were astonished this week by press reports that the government was considering new limits on stem cell research. The Melbourne broadsheet *The Age* reported on 26 February that senior ministers had agreed "in principle" to bar scientists from harvesting stem cells from embryos destined to be destroyed by in vitro fertilization clinics—prompting howls of protest from researchers and a hasty retreat by government officials.

Researchers said the reversal would imperil Australia's position as world leader in stem cell studies. Its scientists were among the first to isolate human embryonic stem cells, and they have produced 10 of the 73 cell lines approved by the National Institutes of Health for use by taxpayer-funded researchers in the United States. Prospects looked bright after the government spent heavily on a new tissue research center and a parliamentary panel last year recommended against restrictions.

So there was an instant uproar upon reports that the head of that panel, Minister of Ageing Kevin Andrews, had broken ranks and convinced a majority of ministers to support embryo restrictions. Andrews quickly issued a statement denying that the government had reached a decision. Still, researchers are wary. Says Martin Pera of Melbourne's Monash University: "We hope there's less to this than meets the eye."

Fish Fight South African ichthyologists are protesting a government decision to strip the name of a famous fish scientist from a prominent research center. The J. L. B. Smith Institute of Ichthyology in Grahamstown was named after the scientist who described the rediscovered coelacanth in 1938. But last year, government officials rechristened it the South African Institute for Aquatic Biodiversity, saying the new name would better reflect the institute's broader future mission.

Several institute scientists, however, are challenging what they call the "undemocratic" erasure of Smith's legacy. The name change is a "political ploy of dubious worth," ichthyologists Eric Anderson and Phil Heemstra charge in a recent open letter to members of the American Society of Ichthyologists and Herpetologists—if only because budget constraints mean the institute will remain focused on fish for the foreseeable future. Institute officials weren't available for comment, but Anderson is hoping that international pressure will convince them to restore Smith's name to prominence, perhaps as part of the titles of journals published by the institute.

of transgenics, the committee urged the agency to consult more with outside scientists and strengthen its expertise in ecology, and it also suggested that an independent organization set up a program for long-term monitoring of transgenic plants.

"The take-home message is that we haven't had a significant environmental problem yet, but that the review process is inadequate," says Daniel Simberloff, an ecologist at the University of Tennessee, Knoxville. "If the major recommendations of this report are adopted, it would greatly lessen the probability of an accident."

Regulation of some transgenic plants falls to the Animal and Plant Health Inspection Service (APHIS), a branch of USDA. A biotech company has two choices when it wants to field-test a transgenic plant: It can apply for a permit, or it can simply notify APHIS that the plant meets general safety guidelines. APHIS must reply in 30 days if it has objections. The vast majority of applications—about 1600 a year—take the notification route.

In some cases, say, those that involve very minor changes to an already approved transgenic plant, APHIS's streamlined notification process is appropriate, the committee said. But speedy review can result in slip-ups. For instance, in 1997 APHIS used the notification process to approve field-testing of a corn variety engineered to contain a glycoprotein called avidin that is toxic to at least 26 insect species—in violation of its own guidelines.

Calling APHIS's handling of ecological issues "superficial," the committee said that if APHIS can't strengthen its reviews, it should leave them to the Environmental Protection Agency. The committee also recommended that APHIS convene a scientific advisory board and consult it before changing its policies on how it regulates new types of transgenic plants. To check for unanticipated impacts, the committee called for long-term monitoring of transgenic crops—something not done now in the United States.

Spokesperson Val Giddings of the Biotechnology Industry Organization says the call for more scientific input is "logical," but he doesn't think there's a need for more extensive monitoring of environmental effects. In a statement, APHIS director Bobby Acord noted that "USDA has already addressed some specific issues raised in the report." The agency, which asked for the review, declined to provide details.

"I hope this report will stimulate improvements in the staffing levels and general procedures at APHIS," says Allison Snow, an ecologist at Ohio State University, Columbus. "A stronger, more rigorous regulatory process is essential if the world is going to accept GM [genetically modified] products."

–ERIK STOKSTAD

PALEONTOLOGY

T. rex Was No Runner, Muscle Study Shows

When the "dinosaur renaissance" blossomed in the 1970s, the sluggish, lizardlike denizens of natural history museums got a kick in the scaly pants. Paleontologists found evidence for higher metabolisms and more erect postures, the giant sauropods emerged from the swamps, and *Tyrannosaurus* raised its tail and lowered its head into an aggressive crouch. A few paleontologists argued, based on limb proportions, that the fearsome beast could even have run as fast as 72 kilometers per hour—a possibility that *Jurassic Park*'s nip-and-tuck jeep race exploited for maximum terror.

A stretch. Large animals such as *Tyrannosaurus* or a 6000-kg chicken couldn't carry enough leg muscle to run.

CREDIT: LUIS REY

Now a new biomechanical model suggests that the movie characters wouldn't have had much to worry about. In the 28 February issue of *Nature*, John Hutchinson, a postdoc at Stanford University, and Mariano Garcia, now at BorgWarner Automotive in Ithaca, New York, argue that a 6000-kilogram *Tyrannosaurus* could not have packed enough muscle into its legs to hustle faster than about 40 km/h. Although the finding doesn't change ideas about *Tyrannosaurus*'s hunting ability, paleontologists say the study sets a new standard for biomechanical analysis of an extinct organism. "This is one of the most sophisticated studies on dinosaur locomotion ever," says Greg Erickson of Florida State University, Tallahassee.

Primed by seeing *Jurassic Park* and gorging himself on dinosaur books, Hutchinson entered graduate school in paleontology with the idea of studying the biomechanics of *Tyrannosaurus*. He and Garcia, then a postdoc at the University of California, Berkeley, designed a simple model of the forces on tyrannosaur leg bones. They modeled the rotational forces exerted when a limb touched the ground while running. The equation revealed how much muscle would have been required to balance forces and keep the dinosaur on its feet.

To test the model, the researchers studied the closest living relatives of dinosaurs: reptiles and birds. Hutchinson dissected a chicken and an alligator and weighed their muscles. The model suggested that a chicken would need to invest at least 4.7% of its body mass in its leg muscles in order to run fast. The chicken turned out to have 8.8%, showing that it had a large margin of safety to deal with the forces generated during a run. In contrast, alligators, which do not run, had only 3.6% of the their body mass in each hindlimb—nowhere near the 7.7% minimum the model predicted.

Hutchinson then studied *Tyrannosaurus* bones, picked a posture that most postrenaissance paleontologists would consider reasonable, and ran the model. It suggested that in order to run, a tyrannosaur would have needed to carry 86% of its body mass as extensor muscles in its legs. To double-check, they analyzed how different parts of the animal's physique affected the results. The most important factors, such as orientation of the limbs and the length of the muscle fibers, could have led to a threefold variation in minimum muscle mass. But even with the most liberal assumptions, a dashing tyrannosaur would have needed 26% of its muscle mass in its legs—far more than living animals have. Hutchinson and Garcia estimate that the fastest a tyrannosaur could have traveled was 40 km/h.

Most paleontologists agree that *Tyrannosaurus* was no Carl Lewis. In 1989, R. McNeill Alexander of Leeds University, United Kingdom, showed that the tyrannosaur leg bones would have cracked under the stress of a wind sprint. And Jim Farlow of Indiana University–Purdue University Fort Wayne calculated that a *Tyrannosaurus* would have seriously hurt itself if it tripped at high speed. But even without sprinting, a tyrannosaur would still have been able to hunt, Hutchinson and other paleontologists say. Large prey such as duckbilled dinosaurs and *Triceratops* would have been limited by the same factors and probably couldn't have run fast either.

Why does speed matter? Once an upper limit is established, Don Henderson of the