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

University of Calgary in Alberta notes, paleontologists can put a cap on ecological questions such as how much territory a tyrannosaur could patrol in a day and how many top carnivores an area could support. Hutchinson says the technique of calculating minimum muscle mass could be used to answer other questions, such as whether sauropods or pterosaurs could walk bipedally and which early tetrapods had the strength to walk on land. –ERIK STOKSTAD

ASTRONOMY

Solar System Kicks Up Its Own Dust

An alien civilization might be able to deduce the existence of planets in our solar system by examining the infrared light emitted by a ring of dust around our sun. A team of astronomers argues that the telltale dust could not have formed without planets, and they propose that stars surrounded by similar rings may be a good place to search for extrasolar planets.

Dust beyond the orbit of Saturn was first detected in the 1970s by NASA's Pioneer 10 and Pioneer 11 spacecraft. But no one knew whether it came from inside or outside the solar system. One clue came from the realization that the dust must get replenished—otherwise, it would get sucked up by the sun or ejected from the solar system.

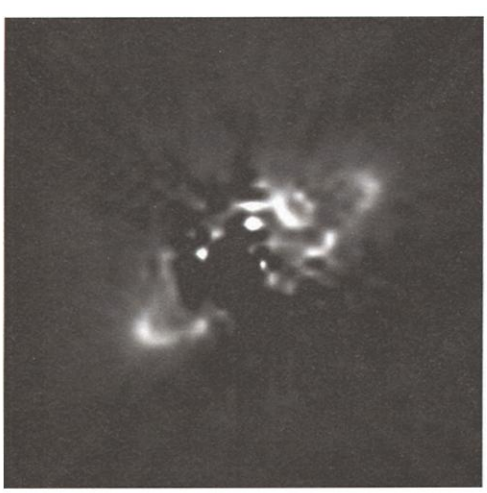
Markus Landgraf of the European Space Agency (ESA) and colleagues suspected that colliding objects in the Kuiper Belt—a flat cloud of debris in the outer solar system probably left over from planet formation—might be kicking up the dust. Using measurements of interstellar dust recorded by detectors aboard ESA's Ulysses spacecraft, the team determined that the grains the Pioneers had observed were too coarse to have come from outside the solar system. The only possible source is the Kuiper Belt, according to computer simulations to be published in *The Astrophysical Journal*. Landgraf's team calculates that about 50 tons of dust are created each second inside the belt—enough to maintain a dust ring that should be bright at infrared wavelengths when seen from afar. Another key signal of planets should be a distinctive pattern of gaps and edges in the dust cloud, carved out by gravitational resonances with Jupiter and other giant planets.

"It's a very interesting report," says David Trilling of the University of Pennsylvania in Philadelphia. "Looking for gaps or structures in dust disks [around other stars] is a very compelling way to look for planets." Rings of dust that emit infrared light have been discovered around a number of nearby stars, and Trilling's team has been searching for dust around more than 40 others. So far, though, no one has found stars that have both planets and a dust ring.

–GOVERT SCHILLING

Govert Schilling is an astronomy writer in Utrecht, Netherlands.

CREDITS: (TOP TO BOTTOM) JAN PITMAN/AP; ESA



Dusty disk. Seen from afar at infrared wavelengths, our solar system might resemble star HR4796A, which also sports a bright dust ring.

JAPAN'S UNIVERSITIES

Reforms Would Loosen Bonds, Cut Safety Net

TOKYO—Japanese academics appear set to win new freedoms that would allow closer collaborations with private companies and greater autonomy in spending research grants. But they may have to pay a steep price: an end to the security of jobs for life and, perhaps, stricter evaluations of the quality of their work.

Last week, an advisory panel to the Ministry of Education, Culture, Sports, Science, and Technology recommended abolishing civil servant status for academics. The recommendation, expected to appear in a final report later this month, would grant administrators flexibility in hiring, including the option of putting staff on fixed-term contracts. If the change applies to current employees—now subject to legal debate—it could affect 60,000 faculty members and 58,000 staff at 98 national universities and 15 institutes.

As civil servants, academics enjoy lifetime employment, and the vast majority of researchers remain at one institution for their entire careers. Reformers have argued that this leads to a stagnant scientific environment. "The biggest problem of the university system is the lack of mobility [among academics]," says Shinichi Nishikawa, a molecular geneticist at Kyoto University's Graduate School of Medicine, who serves on the advisory panel.

The employment issue is the last major

ScienceScope

Patent Fight, Round 2 French, Belgian, and Dutch groups are opposing the second of three European patents awarded last year to an American biotech company for a breast cancer test. The test, marketed by Myriad Genetics of Salt Lake City, Utah, detects mutations in the *BRCA1* gene, which are responsible for more than half of all hereditary breast cancers. Opponents argue that the patents are too broad and would block the development of alternative tests. The challenge, filed with the European Patent Office in Munich on 22 February, is supported by the governments of the three countries.

Last fall, many of the same organizations—including the Curie Institute in Paris and Belgian and Dutch human genetics societies—filed a challenge to the first patent, which covers use of the gene's sequence to create diagnostic tests (*Science*, 14 September 2001, p. 1971). The second patent covers a list of specific mutations in *BRCA1* implicated in breast and ovarian cancers. The patents give Myriad "a monopoly on genetic testing anywhere and anyhow," says molecular geneticist Dicky Halley of Erasmus University in Rotterdam. Greenpeace protesters hung a banner on the patent office in Munich (above).

Myriad officials were not available for comment, but they have said that the patents are justified.

Loka Lucre Supporters of the Loka Institute are scrambling to save the nonprofit organization from a severe cash crunch. Founded in 1987, the Amherst, Massachusetts–based Loka is devoted to increasing grassroots involvement in science and technology. It has pioneered the U.S. use of "science shops," workshops designed to address local issues and attract input from community groups.

But executive director Jill Chopyak resigned last month, and the funding climate for nonprofits "has been brutal," according to a recent board statement, forcing the group to suspend operations.

Still, Chopyak believes the problems won't be "the death of Loka. The board is really committed to expanding the donor base." Directors say they want to raise $100,000 by 1 August. For the time being, Khan Rahi, who coordinates Loka's Community Research Network, will oversee the institute.

Contributors: Elizabeth Finkel, David Malakoff, Michael Balter, Andrew Lawler