things. What message does this [demand] send to other institutions?"

Officials respond that the National Institutes of Health, of which NCI is part, states in its grant policy that awards may have to be returned if they're misspent. Kalt adds that NCI has previously recovered research grants in "a small number of [misconduct] cases"—although they are the exception. Although ORI doesn't track recovered grants, Lawrence Rhoades, director of ORI's Division of Policy and Education, says he's aware of only a few cases among the 100 or so misconduct findings by ORI since 1992. "Figuring out how much money the government should get back is not always easy to do," explains Rhoades. Often the scientist found guilty played a small role in a study, or the overall conclusions are still valid.

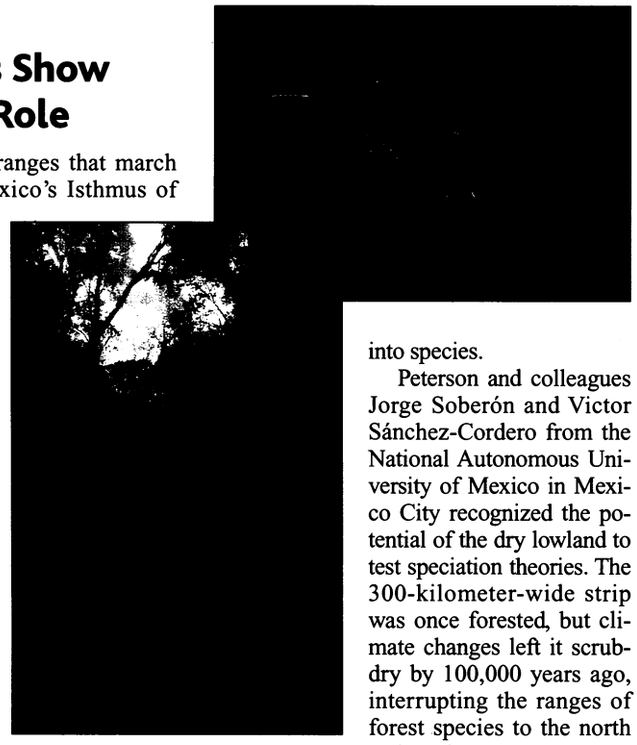
To Bissell this inconsistency adds to the unfairness of NCI's demand. The NCI letter gives LBNL 30 days to either pay or appeal the decision. Kolb says the lab plans to appeal.

–MARCIA BARINAGA AND JOCELYN KAISER

SPECIATION

Mexican Pairs Show Geography's Role

The forested mountain ranges that march across each side of Mexico's Isthmus of Tehuantepec are a naturalist's paradise, full of rare birds, mammals, and butterflies. They are a playground for evolutionary biologists too, because these nearly identical habitats were separated relatively recently, when climate change created an arid strip between them. Now, researchers who examined pairs of species on either side of the lowland report on page 1265 that they have new evidence that such geographic barriers are the major force driving the formation of new species.



Where species are born. This hummingbird and many other species arose in the cloud forests of the Isthmus of Tehuantepec.

Biologists since Darwin have analyzed—and argued about—how species are born. Recently researchers have looked favorably on a version of Darwin's own idea: that populations of a single species can separate when they change their ecology, adapting to different temperatures, food resources, or other environmental conditions (*Science*, 25 June, p. 2106). But after examining 37 pairs of closely related species, one from each side of the arid Tehuantepec barrier, a team led by ornithologist A. Townsend Peterson of the Natural History Museum of the University of Kansas, Lawrence, found that members of each pair had similar ecological niches. In every case it appears that the geographic barrier, rather than any difference in ecology, was the critical factor in speciation, isolating the original populations so that they accumulated genetic differences and eventually became unable to interbreed, says Peterson. "Speciation is taking place simply because of geographic isolation," not through ecological adaptation, he says.

The idea of geographical speciation is well understood, but unambiguous examples are rare. "Showing it the way they did ... is pretty clever," says Robert Zink, curator of birds at the Bell Museum in St. Paul, Minnesota. Even so, he and others warn against dismissing the role of ecology in speciation, because the method needs refinement and there are counterexamples in which ecological differences have driven populations apart into species.

Peterson and colleagues Jorge Soberón and Victor Sánchez-Cordero from the National Autonomous University of Mexico in Mexico City recognized the potential of the dry lowland to test speciation theories. The 300-kilometer-wide strip was once forested, but climate changes left it scrub-dry by 100,000 years ago, interrupting the ranges of forest species to the north and south.

To carry out their test, the team used published literature to identify 37 pairs of sister species on either side of the isthmus and searched museum records to find out where specimens of each species were collected. They used these location data to define each species' ecological niche based on four conditions: temperature, precipitation, elevation, and vegetation. They then plugged these parameters into a computer program to determine the potential geographic range of each species.

Peterson tested whether the observed ecological niche of one species could predict the niche and range of its sister. For all 37 species pairs, the answer was yes. For instance, the ecological parameters favored by a blue mockingbird also predicted the range of its counterpart south of the barrier, a blue-and-white mockingbird. This means that each species' niche remained stable throughout the speciation process. Such conservatism makes it "pretty clear that speciation did not take place in an ecological dimension," says Peterson.

The work offers "an intriguing contribution" to the speciation debate, says biologist Thomas Lovejoy of the Smithsonian Institution. However, Trevor Price, an ornithologist at the University of California, San Diego, says he and others don't doubt that geography can create new species; what they want to know is when and how ecology plays a role, too. "We are now asking what is the role of ecology over and above geographic isolation," he says. And he thinks Peterson's study may have overlooked some complexities. An ecological niche is much more than just four physical parameters, he notes. Herpetologist David Wake of the Museum of Vertebrate Zoology in Berkeley, California, adds that the literature identifying species as sisters may or may not be accurate, nor is it certain that all of the supposed sisters were born when the barrier appeared.

Nonetheless, Wake and other researchers agree that Peterson's method of predicting geographic ranges from ecological data holds great promise. Peterson is now improving his method to incorporate dozens of ecological parameters and applying it to predict the potential distribution of invasive species. "If their analysis holds ... they'll have the ability to predict where species will and won't occur as habitat changes," says Zink. "[They could] forecast the fate of species"—a valuable power indeed.

–BERNICE WUETHRICH

Bernice Wuethrich is an exhibit writer at the Smithsonian's National Museum of Natural History in Washington, D.C.

ANIMAL TESTING

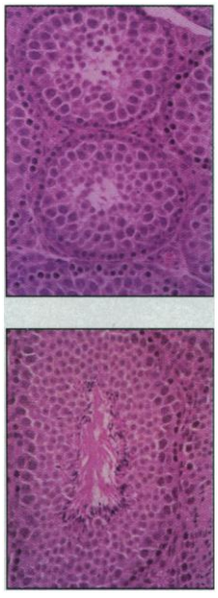
One Mouse's Meat Is Another One's Poison

Just as government labs are gearing up for a major campaign to ferret out industrial chemicals and pollutants that mimic sex hormones, scientists have discovered that some of their favorite test subjects—lab mice—vary greatly from strain to strain in their sensitivity to the hormone estrogen. According to a report on page 1259, estrogen injected into young male mice sharply curtails testis growth and sperm production in some strains, while leaving a

CREDITS: K. ZYSKOWSKI/VIREO

widely used lab strain—designated CD-1—essentially unperturbed.

The findings raise concern about whether current animal tests adequately gauge the human health risks that hormone mimics may pose. The new findings "may have significant implications," says reproductive biologist Earl Gray of the Environmental Protection Agency's (EPA's) health effects lab at Research Triangle Park, North Carolina. CD-1 has been the mouse of choice, he says, for studying hormone mimics. If CD-1 mice prove insensitive to such compounds, adds reproductive biologist Frederick vom Saal of the University of Missouri, Columbia, then "these are the last animals you'd want to use" for testing. Researchers caution, however, that they have not yet determined whether the animals show the same range of sensitivity to hormonelike chemicals as they do to the real McCoy.



Impervious to estrogen. Sperm flourish at center of tubule in testis of CD-1 mice *(bottom)*, but not in other strains *(top)*.

Jimmy Spearow, a reproductive geneticist at the University of California, Davis, says he first uncovered strain-to-strain differences in hormone sensitivity in the late 1980s. Then a few years ago, he got a surprise when reading papers on the physiological effects of hormonelike chemicals in mice. "I said, 'Oh my God, they're using the most resistant strains!' " Spearow recalls. To probe further, he and colleagues implanted estrogen plugs under the skin of juvenile male mice from four strains. The capsules released doses of 17β-estradiol ranging from 0.2 to 2.0 micrograms per gram of body weight for 3 weeks.

At the lowest dose, mice from the most sensitive strain, B6, developed testes that weighed 60% less than those of control animals. In CD-1 mice, however, the same dose reduced average testis weight by just 10%. Similarly, the numbers of maturing sperm dropped precipitously at the lowest doses in sensitive strains. CD-1 mice implanted with twice the amount of estrogen necessary to stop sperm production in other strains still produced roughly 90% of normal levels of maturing sperm. Overall, the researchers report, other strains are about 16 times more sensitive to estrogen than CD-1 mice.

The findings are intriguing in part because CD-1 mice have been bred to produce large litters. Spearow speculates that the physiological factors responsible for fruitful parenthood have rendered the mice relatively impervious to outside estrogens. Indeed, after breeding two strains—S15/Jls and C17/Jls—over some 70 generations, the one Spearow selected for large litter size, S15/Jls, was less sensitive to estrogen than was the other strain. "It's a biologically plausible hypothesis," says Gray, who thinks breeding for litter size "is certainly going to affect the reproductive system somewhere."

The new data suggest to vom Saal at least that "the risk assessment process substantially underestimates variability in animal populations." Wild variation could undermine the fudge factor built into animal tests to protect human health: When setting safe exposure levels for people, researchers take the dose found to be safe in lab animals and divide it by a factor of 10—to account for variability from person to person—before setting a permissible exposure level. But the gulf between CD-1 and the most estrogen-sensitive strains is so great, vom Saal says, that it overwhelms the safety factor. "If mice have a substantial potential [genetic] variation in response to estrogen," he asks, "why shouldn't one assume an equal amount of variability in response to hormones in humans?"

Regulatory agencies plan to take no chances. The EPA is now standardizing a test battery and screening procedures that its labs, starting in about 2 years, by law must use to evaluate tens of thousands of chemicals for hormonelike activity. Says Gary Timm, senior technical adviser in EPA's office of science coordination and policy, "Certainly we're interested in using the most sensitive species or strains." **–LAURA HELMUTH**

ASTRONOMY

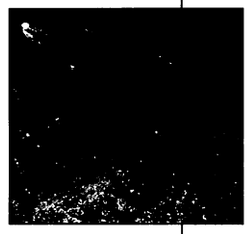
A World With Two Suns

Buried in the unusual twinkling of a star near the center of our galaxy, an international team of astronomers has uncovered the first evidence of a planet orbiting two stars at once. If other observers can confirm it, the Jupiter-sized planet will be more than an astronomical novelty. Its detection, which the Microlensing Planet Search collaboration describes in a paper posted on the e-print server at Los Alamos National Laboratory (xxx.lanl.gov/abs/astro-ph/9908038), will become a triumph for a new and potentially powerful technique for finding planets around other stars.

Extrasolar planets are too dim to be seen directly. The several dozen detected so far have betrayed themselves by tugging their

ScienceScope

Mongrel Salmon? Salmon genes are back in the spotlight. Two conservation groups last week filed suit in Washington, D.C., to force the federal government to list Maine's few remaining Atlantic salmon as endangered, charging that a 2-year-old voluntary plan to protect the fish doesn't go far enough. Less than 100 salmon returned to seven Maine rivers last year to spawn, down from at least 20,000 a century ago.



The suit—which joins similar complaints filed earlier by other groups—could force a replay of a scientific tussle. In 1997, federal officials declined to list the Maine fish, in part because genetic studies suggested that they were not "distinct" enough from nearby Canadian runs to merit protection under the Endangered Species Act (*Science*, 6 February 1998, p. 800). State officials—who fear listing could force restrictions on timber harvesting and farming—insist the fish are mongrels produced by inbreeding with stocked fish and don't deserve listing.

But new studies "undermine the state's position," says Steve Moyer of Trout Unlimited in Washington, D.C., which is suing along with the Atlantic Salmon Federation. Salmon science is expected to go on trial this fall.

Compelling Enough? Scientists have come up with 10 reasons for restarting the Fast Flux Test Facility, which has been idle since 1993 (*Science*, 4 April 1997, p. 28). But politicians hope the arguments won't sway Energy Secretary Bill Richardson, who must decide by next month whether to spend as much as $400 million to bring the nuclear research reactor back to life.

Earlier this month, a DOE advisory panel said the Hanford, Washington, facility—part of Pacific Northwest National Lab—had 10 potential uses, including fusion and materials research, and urged Richardson to begin an environmental study of its restart. But opponents, including lawmakers from nearby Oregon, are concerned that it might add to Hanford's serious environmental problems. Heartened by Richardson's rejection last year of a plan to use the reactor to produce tritium gas for nuclear weapons, they now hope "he kills it once and for all," says an aide to one Oregon senator.

Contributors: Michael Baker, Jocelyn Kaiser, David Malakoff

CREDITS: (LEFT PAIR) SPEAROW *ET AL.*; (RIGHT) K. OSF RINGLAND/ANIMALS, ANIMALS