an emphasis on saving face.

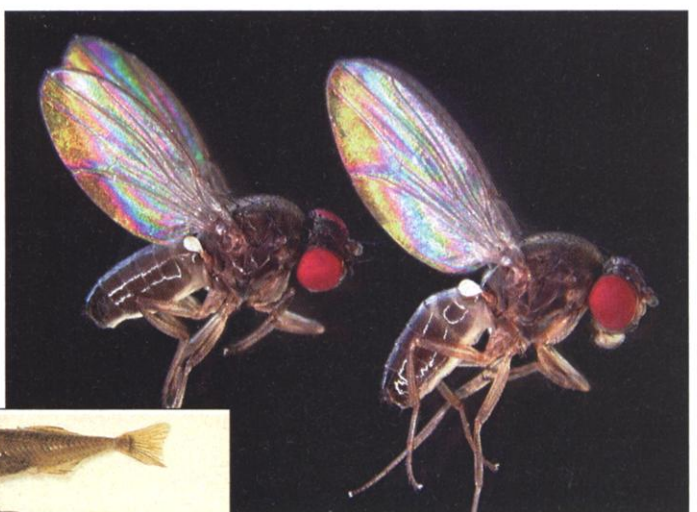
Yoo admits that her project hinges in part "on who I find" for the collaboration, a two-way street that will include training Korean students in U.S. labs. But if all goes well, she predicts, "the 21st Century Program will be a milestone [in our] leap … to a more advanced scientific level." **–MICHAEL BAKER**

Michael Baker writes from Seoul.

EVOLUTION

Nature Steers a Predictable Course

In Darwin's original formulation of his theory of evolution, he emphasized the importance of the local environment in shaping how organisms change through time. Over the past 2 decades, however, his assumption that natural selection, as it is known, is invariably the driving force of evolution has fallen somewhat out of favor. Some evolutionary theorists have argued that "genetic drift," random gene changes that accumulate over time, underlies the evolution of new species. Thus, even with natural selection, evolution's course should be rather unpredictable and not likely to be repeated time and time again, they concluded. But results reported in this issue by two independent teams indicate that natural selection seems to be as important as Darwin had thought, often overriding the randomness of genetic drift.



Parallel projection. European fruit flies in the New World are evolving wing size differences much like those seen in the flies in their native Europe *(above)*.

Like-minded lovers. Both the slighter fish (top two) and the hefty ones (lower two) accept similar-looking mates from distant lakes, despite their independent evolution.

CREDITS: (LEFT TO RIGHT) DOLPH SCHLUTER/UNIVERSITY OF BRITISH COLUMBIA; GEORGE W. GILCHRIST/CLARKSON UNIVERSITY; WAKAYAME *ET AL.*, *PNAS* 96 (26), 14987 (1999)

Both teams took advantage of nature's own evolutionary laboratory. Raymond Huey of the University of Washington, Seattle, and his colleagues studied a European fruit fly, *Drosophila subobscura*, that was introduced into California some 20 years ago. As the researchers report on page 308, they found that over the south-to-north range of the flies, the insects have evolved larger wings, a change that parallels what happened to this species in Europe.

Dolph Schluter of the University of British Columbia (UBC) in Vancouver and his colleagues studied a very different species, a stickleback fish living in three isolated lakes on British Columbia's Pacific coast. In work described on page 306, the researchers report that the same two species have formed in all three lakes. Each lake contains one with hefty, bottom-dwelling individuals and one with streamlined individuals that feed in the open water. Both studies provide strong evidence confirming "the importance and strength of natural selection as the major agent of evolutionary change," says Douglas Futuyma, an evolutionary biologist at the State University of New York, Stony Brook.

Even the entomologists who first noticed the distinctively black European fruit flies in California almost 20 years ago thought this species provided an opportunity to see evolution in action. But Huey and George Gilchrist, now an evolutionary biologist at Clarkson University in Potsdam, New York, and their colleagues were the first to test whether the flies evolved the same way in the New World as they had in the old. In 1997, they collected *D. subobscura* flies from 11 spots ranging from just north of Santa Barbara, California, to north of Vancouver. The following year, Huey and Spanish colleagues trapped the flies over roughly the same range of latitudes in Europe, traversing the continent from southern Spain to the middle of Denmark.

The team then raised the different popu-

ScienceScope

Mouse Victory Following an appeal from animal rights groups, the National Institutes of Health (NIH) has agreed to scale back its use of a technique for making lab reagents—the "mouse ascites method"—which requires killing an estimated 1 million mice per year. In a policy shift, NIH says it "strongly supports" the adoption of new, in vitro approaches for making monoclonal antibodies. The ascites method involves injecting tumors into mouse abdomens and extracting antibodies with a needle. NIH did not ban the technique but promised to support a transition to in vitro methods.

"We're declaring victory," says John McArdle, a scientist now involved in animal rights work at the Alternatives Research and Development Foundation (ARDF) in Eden Prairie, Minnesota. McArdle predicts that 90% of monoclonal antibodies will be produced by in vitro methods in a short time. ARDF is the research arm of the American Anti-Vivisection Society of Jenkintown, Pennsylvania, which petitioned for this change (*Science*, 9 April 1999, p. 230).

Cyber Antidote Alarmed by rampaging computer viruses and the nation's vulnerability to hack attack, the White House is moving to beef up efforts to combat cyberterrorism. A new initiative intends to plow more funds into R&D on data security.

The plan calls for roughly $90 million in the 2001 budget; big-ticket items are $25 million for a program to lure budding cybercops into government service and $50 million for an Institute for Information Infrastructure Protection, run by the National Institute of Standards and Technology (NIST). The new shop would hand out peer-reviewed grants that "fill gaps" in the current research portfolio, which includes projects aiming to foil individuals who try to hack into corporate networks, as well as secretive work on thwarting the concerted code-cracking efforts of foreign powers. Exactly which promising areas are unfunded is still being deciphered, says Edward Roback, acting chief of NIST's computer security division. Another unknown is the response from Congress, which will consider the president's budget request later this year.

Contributors: Eliot Marshall, Jeff Mervis, Charles Seife

lations of flies, providing the same food and living conditions for them all. After allowing a half-dozen generations to go by, the researchers measured the wing lengths—an indicator of overall body size—of flies from each locale. The results were striking, particularly in the females, says Gilchrist.

He and his colleagues saw an increase in wing size—to a 0.1-millimeter difference, or 4%—in the European flies collected from south to north. And they saw the same increase in the fruit flies from North America, even though the species had spent only a brief time on the continent. Indeed, Andrew Hendry of the University of Massachusetts, Amherst, who has recently completed a survey of evolutionary rates, says that the change "is as fast as I have ever seen. I think this will shake up a lot of people." The adaptive significance of the change is unclear. Still, says evolutionary biologist Jeff Mitton of the University of Colorado, Boulder, the fact that it occurred twice in similar environments makes for "a very clean and compelling story" in favor of natural selection.

The genetic basis of the change may be different in the European and North American versions of *D. subobscura*, however. Huey and his colleagues found that the European populations lengthened the part of the wing closest to the body, while those in North America extended the outer segment. The work shows that "there can be different ways of attaining the same outcome," notes Futuyma, and thus some aspects of evolution may still be random and unpredictable.

Schluter's team found that the sticklebacks they studied represent an even more dramatic case of parallel evolution. Originally of marine origin, the fish were trapped in coastal lakes formed some 10,000 years ago by a retreating glacier. The lakes are isolated from one another—indeed, two are located on separate islands along the coast—yet each of the three lakes wound up with the same two noninterbreeding varieties of stickleback, the bulky benthic type and the actively swimming limnetic type.

To understand the basis of the reproductive isolation, UBC's Laura Nagel, Janette Boughman, and Howard Rundle tested the mating preferences of the fish. They found that females choose males that look like themselves. For example, benthics mated with benthics, both from their own lake and the others, while shunning all limnetics. "Whatever it is that makes the benthics dislike the limnetics, it's happened over and over again," Schluter explains. That finding, adds Mitton, was "a real surprise" and shows that natural selection can yield new species.

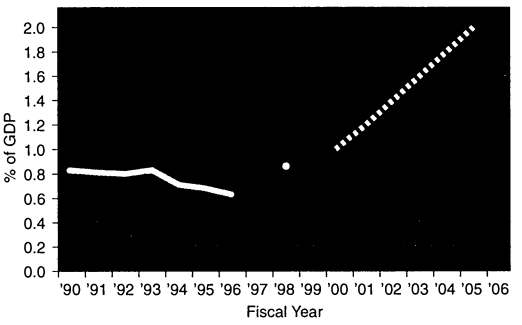
The more researchers probe the corners of nature's laboratory, the more evidence they are likely to find supporting the importance of natural selection, Mitton says. For example, he sees repeated patterns of evolution in some traits of the pinyon pines that he studies. These examples "say that natural selection can cause a population to change very quickly and hint that speciation could [occur] very quickly," he notes. And that makes him even more sure that Darwin was right after all.

–ELIZABETH PENNISI

SCIENCE FUNDING

Budget Doubling in View for Indian R&D

NEW DELHI—Indian scientists are cheering the prospect that the country's research budget could leap by 30% this year and then double over the next 5 years. Last week, Prime Minister Atal Behari Vajpayee announced that his government would hike R&D spending to 1% of gross domestic product (GDP) this year and to 2% by 2005, effectively linking science spending to the country's overall economic growth. (The prime minister pegs the current percentage at 0.86%; however, the most recent official estimate is only 0.66%.) The announcement surprised even his own science managers, who immediately set to work on plans to allocate the additional resources. Indian officials have long acknowledged that the country lags behind other democracies in funding science.



Up with science. Vajpayee has promised to boost R&D spending by tying it to a growing share of the country's GDP.

"By world standards, India's investments in R&D are wholly inadequate and subcritical," Vajpayee told some 3000 scientists in a keynote speech that opened the annual meeting of the Indian Science Congress in Pune. In addition, much of the spending has gone to support India's large defense establishment and sectors related to national security, notably space and nuclear power. The new policy is seen as a long-term commitment to a growing and more diversified portfolio, including basic research. "This means that [R&D's share of] the pie will only increase in years to come," says Science and Technology Minister Murli Manohar Joshi. He claims that it took him nearly 2 years to convince the prime minister to make what he described as a "historical announcement."

The news is expected to translate into a jump from $2.5 billion to $3.25 billion in R&D spending in the fiscal 2000 budget to be announced at the end of February. If Vajpayee keeps his promise, the budget would rise by some $500 million or more in each of the next 5 years in step with the GDP, which is growing at 6.5% a year. On Monday India's finance minister, Yashwant Sinha, solicited ideas from a group of scientists and said that the government would emphasize innovation and competition in any new spending plans.

The announcement was a "bolt out of the blue," says Valangiman Subramaniam Ramamurthy, head of the Department of Science and Technology in New Delhi. He and his counterparts will meet here next week to draft spending priorities that are expected to draw heavily from a 23-volume planning document prepared recently by the Technology Information Forecasting and Assessment Council, a quasi-government think tank. Ramamurthy told *Science* that a third of the new money is likely to be allocated to "blue-sky projects" and other basic research, with the rest going to applied technologies. He says "mission-oriented programs" are likely to be the main beneficiaries, in particular, bioinformatics, nanotechnology, smart materials, and the more efficient burning of coal. The increases are likely to be spread over several agencies, Ramamurthy said, citing such recent projects as the Ministry of Food's efforts to develop more efficient technologies for the sugar industry. Some experts say much of the new money could go to the defense and nuclear agencies.

Scientists applauded the news and immediately proposed their own candidates for greater support. Goverdhan Mehta, director of the Indian Institute of Science in Bangalore, made a plea for beefing up India's university system, which he says "has virtually collapsed." In their meeting with Sinha, scientists stressed tax reforms, greater industrial participation, and incentives for bioprospecting. C. N. R. Rao, president of the Jawaharlal Nehru Center for Advanced Scientific Research in Bangalore, whose recent call for a doubling of current spending levels in both education and science (*Science*, 12 November 1999, p. 1295) triggered a parliamentary debate on the country's R&D policy, is optimistic that the new policy will not be overturned. "I do not see why this government cannot keep its promise," he says.

–PALLAVA BAGLA

CREDIT: GOVERNMENT OF INDIA