

better; it's like getting into a custom-built motorcar," he says.

Whatever the underlying reasons, the devotion of many musicians to rare or precious materials could help contribute to their extinction. *Dalbergia melanoxylum*, known as M'Pingo, grenadilla (African blackwood) and *D. nigra*, also called rosewood or palisander, are considered endangered, says Richard F. Fisher, a forest scientist at Texas A&M University. Grenadilla is the wood of choice for clarinets, oboes and, increasingly, wood flutes and piccolos; rosewood is a favorite for recorders.

Although the demand for fine musical instruments might seem too small to inspire a debilitating harvest of the rain forest, Fisher asserts otherwise. To get to the remote regions where these trees grow, harvesters must clear rivers or build roads. "In many of these areas there are so many landless peasants looking for a piece of land to farm that after you remove just the few trees you want, they go in and invade because now they have access," Fisher says. "They cut down the rest of the forest... and start to grow crops."

Fisher adds that these tropical species are extremely difficult to raise on plantations. They take 60 years or more to reach maturity and tend to grow poorly when raised clustered together in stands, as their key defense against predation is being scarce in the forest.

Indeed, an instrument maker in Libertyville, Ill., Boosey and Hawkes, failed at replenishing M'Pingo trees, says François Kloc, a master craftsman there. To offer an alternative material, the company developed a "green" line of oboes and clarinets. These instruments are made of M'Pingo sawdust and a patented mixture of carbon fiber and epoxy glue that is heat-treated and placed in a press to give it the density of whole wood. This process enables the company to use all of the tree instead of only the prime 20 to 30 percent that was usable before. Old, damaged clarinets can also be recycled in a similar way to make new ones.

Whether such innovations will ultimately be widely accepted by music lovers remains to be seen. "Most musicians and many listeners believe without question that the material of which a wind instrument is made has a profound effect on its tone quality," Coltman remarks. "After 100 years, scientists have still convinced nobody."—*Karla Harby in Rockville Centre, N.Y.*

ANTI GRAVITY

Urine the Money

Time was that the only consequence of drugs in urine was the confiscation of Olympic medals. Now, however, researchers have coaxed lab mice to produce a valuable pharmaceutical agent and in a way that makes it easy to harvest and to purify. Thanks to science that definitely qualifies as being of the "gee whiz" variety, the mice produce the drug in their bladders and simply turn it over to interested parties when they urinate.

Transgenic animals that can produce pharmaceutical agents have been in the works for years, but the bioreactor organ of choice has been the mammary gland—useful drugs derived from animal milk are now in human clinical trials. The idea for trying the same with urine started when Tung-Tien Sun of New York University Medical School published a paper in 1995 describing genes for proteins, called uroplakins, that get expressed only in the bladder. These uroplakins mesh together and probably have a role in maintaining a tidy lining, a highly desirable feature in a bladder.

Kenneth D. Bondioli of the U.S. Department of Agriculture's Gene Evaluation and Mapping Laboratory read Sun's paper and realized that it might be worth trying to tack something useful onto a uroplakin gene. At this point, David E. Kerr and Robert J. Wall, also at the USDA's gene lab, started shuffling genes. The aim was to get a useful human gene to hitch a ride on a uroplakin gene and find acceptance in the chromosomes of a fertilized egg. If they could pull that off, they could create a transgenic animal that produced the human gene's product only in the bladder—mixed up, of course, with the rest of the micturation.

So it came to pass that the research team created transgenic mice, with the gene for human growth hormone rid-

ing the uroplakin gene appropriately designated UP2. And indeed, when this mouse tinkles, it leaves human growth hormone in the cup. (Actually, it does its business on the benchtop, which—take note, new parents with nice furniture—the researchers covered with Saran Wrap for easy collection.) Any commercial application for the bladder bioreactor would involve the creation of larger transgenic animals, such as cows, able to produce urine in buckets rather than thimbles.

For this feasibility study, mice and human growth hormone make for a handy test system. "It was a two-pronged choice," says Wall, leader of the USDA group, who managed not to leak this work to the press prior to its publication in the January *Nature Biotechnology*. True, the molecule does have commercial application to treat dwarfism and potentially to enhance muscle strength in the elderly. More important for this first run, growth hormone gives itself away if any of it gets produced other than in the bladder—what transgenic researchers really do call "leaky expression." Specifically, you get really big mice, easy to weed out via visual inspection.

Harvesting drugs from urine is less oddball than it may appear. The widely prescribed drug Premarin, a type of estrogen, is collected from horse urine. And gonadotropins, used to enhance ovulation, come from the urine of human females.

Urine has some distinct advantages over milk as a vehicle for pharmaceuticals. Number one, as it were, urine contains few proteins naturally, so purifying the product should be easier than purifying milk, with its complex protein mix. Moreover, animals have to reach maturity to produce milk, whereas they start making urine from birth. Finally, all animals, male and female, urinate. So don't be surprised if, down the road, pharmaceuticals derived from urine make a big splash.—*Steve Mirsky*

