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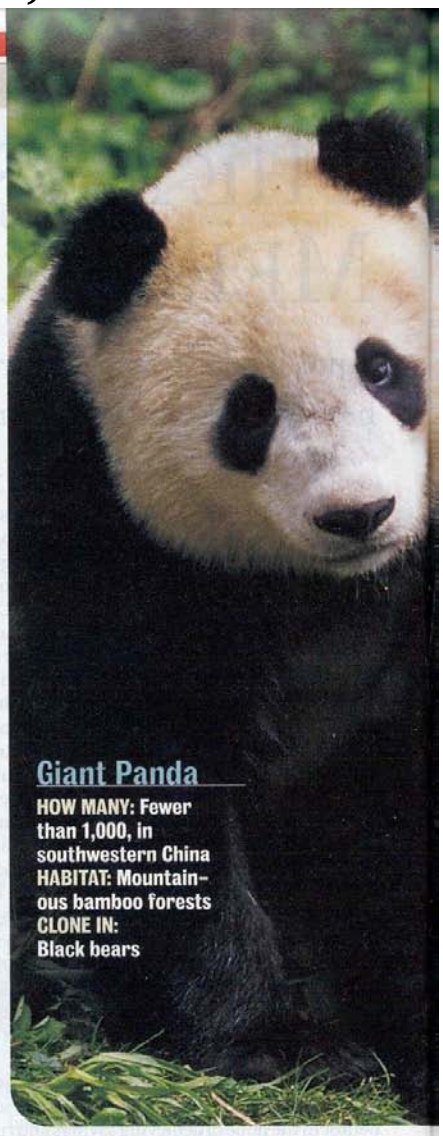
SCIENCE & TECHNOLOGY

With a growing number of species facing extinction, scientists have turned to a desperate strategy: replicate them—in surrogate moms. BY SHARON BEGLEY

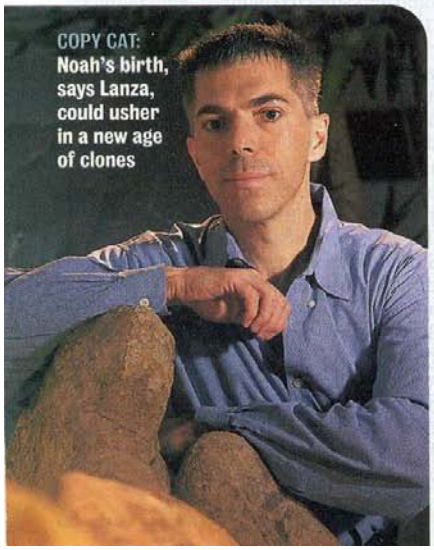
Cloning the Endangered



Giant Panda

HOW MANY: Fewer than 1,000, in southwestern China
HABITAT: Mountainous bamboo forests
CLONE IN: Black bears

HIS BIRTH IS STILL A MONTH away, but already his proud creators have given him a freighted name: Noah. Like his Biblical namesake, Noah got the call to do no less than save the world's endangered creatures—and he doesn't even get a divine helping hand, as far as we know. Noah is a gaur, an oxlike creature whose population in the wild has dwindled to some 36,000. But Noah is something else, too: the first endangered animal ever cloned. If all goes well, he will claim another first. Noah will be born not to a gaur, but to a different beast altogether: an ordinary dairy cow. "This is the first time one species has been cloned using the eggs and surrogate mom of an entirely different species," says Dr. Robert Lanza of the Massachusetts biotech firm Advanced Cell Technology, who announces his team's research in the journal Cloning. "Noah will be living proof that one animal is able to carry, and give birth to, a healthy animal that is the clone of a completely different species."

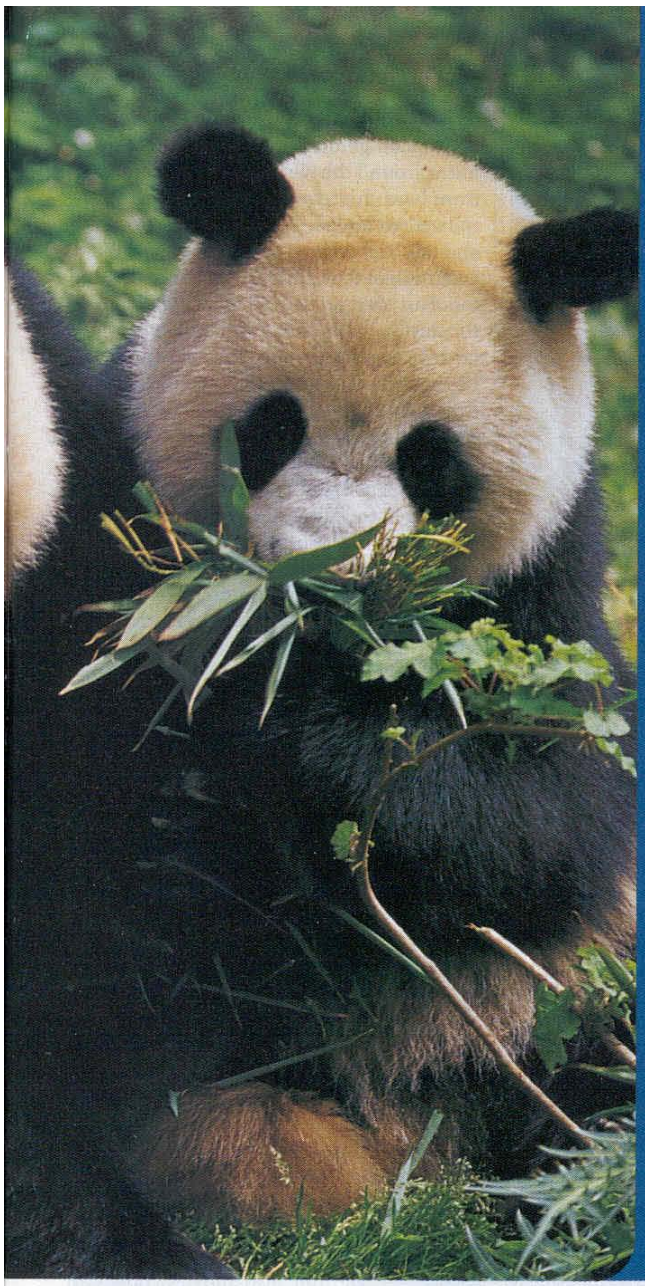


COPY CAT: Noah's birth, says Lanza, could usher in a new age of clones

If cloning seems like a last resort, it is. As the world's wild places vanish, one quarter of all mammals face extinction, including such crowd pleasers as the giant panda, Sumatran tiger and rhino. Since its last assessment in 1996, the IUCN-World Conservation Union reported last month, the number of critically endangered mammals rose from 169 to 180; critically endangered primates alone increased from 13 to 19. Critically endangered freshwater turtles rose from 10 to 24, and birds from 168 to 182. If conservationists could wave a magic wand, they would halt the habitat destruction and hunting that keep sending species the way of the dodo. But since that isn't in the cards, they have opened a second front by launching zoo-based breeding programs. Test-tube babies—ocelots, tigers, gorillas, baboons and others—came first. But test-tube conception requires collecting sperm. To anyone who's ever tried to get some from a gorilla (how? very carefully), cloning's allure is obvious. And although not all animals are fertile, all have the potential to be cloned. That means cloning could increase the genetic diversity of endangered species and prevent catastrophic inbreeding.

The recipe for cloning an endangered species is a variant of the one that created Dolly, the world's first cloned mammal, in 1997. Lanza and colleagues first collected skin cells from a gaur soon after it had died. Then they retrieved oocytes (eggs) from plain old cows killed in an abattoir. Using a needle, they removed each egg's nucleus, which contains cow genes. They injected a gaur cell, complete with its own DNA-containing nucleus, beneath the oocyte's outer envelope. A pulse of electricity made the egg fuse with the gaur cell. The egg grew and divided, forming a ball of cells. The scientists shipped batches of such cells to Iowa, where they were implanted into surrogate mother cows.

Already Noah is a survivor. Out of 692 fused cells, 81 grew and divided into balls of at least 100 cells. Of those, 44 were transferred into 32 surrogate mothers. (Lanza had another batch waiting to go to Iowa, but the overnight-delivery service didn't show.) After miscarriages and other mishaps, only Noah remains. Even getting this far "represents an important mile-



Sumatran Tiger

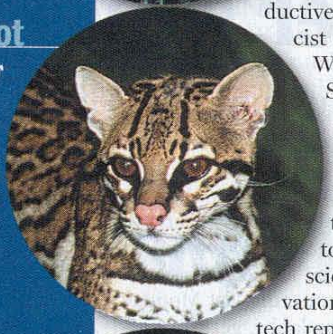
HOW MANY: Fewer than 400, in Indonesia
HABITAT: Grasslands and rain forests
CLONE IN: A feline to be determined

Gaur

HOW MANY: 36,000 in India and southeast Asia
HABITAT: Forests, bamboo jungles, grassland
CLONE IN: Common dairy cow

Texas Ocelot

HOW MANY: Fewer than 250 adults, in Mexico and southern U.S.
HABITAT: Mostly scrub brush
CLONE IN: Domestic cats



Mountain Bongo

HOW MANY: About 50, in a small area of Kenya
HABITAT: Mountain forests
CLONE IN: Common antelope, such as eland

stone," says Ian Wilmut of the Roslin Institute, who led the effort that created Dolly.

Noah seems innocent enough, but research on "interspecific" embryos—genes from one species slipped into the egg of a different species—has stirred up an ethical hornet's nest. In 1998 Advanced Cell announced that one of its researchers had produced a hybrid human-cow embryo: Jose Cibelli had, two years before, taken some of his own cells and fused each with a cow egg. He grew one such early embryo through five cell divisions in a lab dish, but halted the experiment to assess its ethics. Noah is the first such hybrid to develop past a ball of cells in the lab and into a fetus with all the right organs, limbs—even eyelashes and hooves.

Scientists are planning to clone other endangered species. To do that, they need suitable surrogate moms, says Betsy Dresser of the Audubon Institute Center for Research of Endangered Species. Although gestating a gaur in a gaur or a gorilla in a gorilla is more likely to result in a live birth, subjecting females of endangered breeds to the rigors of assisted reproduction might not be the smartest move. Advanced Cell is therefore negotiating with China to clone the notoriously difficult-to-breed panda. Cells from Hsing-Hsing and Ling-Ling, late of the National Zoo, are already on ice, ready to be cloned. They would be slipped into eggs from black bears killed by hunters this autumn in the Northeast; captive black bears would be surrogate moms.

Cloning something as extinct as the stars of Jurassic Park remains fiction (the DNA must be viable), but Lanza has just received permission from Spain to clone the bucardo, a mountain goat that became extinct when a tree fell on "Celia," the last of its kind. The tissue was frozen; if it can be cloned in the egg of a common ibex, the bucardo would live again. "We hope to have live bucardo kids by early summer," says Lanza.

Or so goes the hope. To gestate an embryo in a surrogate "requires using a closely related species with a well-studied reproductive system," says geneticist George Amato of the Wildlife Conservation Society, based at the Bronx Zoo. "That makes it very difficult to apply the technique to many of the species you'd like to help." Even if the science works, conservationists worry that high-tech reproduction will divert scarce resources from programs that could save a greater number of animals: each clone would cost $6,000 to $15,000, even with Advanced Cell allowing zoos free use of its patented process. But that's not $15,000 that would otherwise go to, say, training rangers in Congo, or even toward the billions of dollars needed to preserve habitat. "A corporation interested in biotech just won't fund a development project," notes Amato. A greater concern is that cloning alone would produce a pretty sad Noah's ark: if the wild places vanish, clones of rare species would be little more than "museum pieces," says Russ Mittermeier of Conservation International, hanging on only in zoos. Perhaps if cloning can fill the ark, the world will have a greater incentive to find a place for the animals to disembark. But with Bessies giving birth to gaurs, common elands to rare bongos and other odd two-by-two pairings, the scene will look even stranger than the landing on Mount Ararat. ■

CLOCKWISE FROM TOP LEFT: LYNN M. STONE—ANIMALS ANIMALS; BIOS—PETER ARNOLD; TOM MCHUGH—PHOTO RESEARCHERS; TERRY WHITTAKER—PHOTO RESEARCHERS; ANUP SHAH—ANIMALS ANIMALS; RICK FRIEDMAN