Closer Than Kissing Cousins CHEETAHS

In 1555, Akbar the Great was presented with a cheetah named Fatehbaz—a gift that launched the Indian potentate into a lifetime of cheetah keeping. These swift, gentle cats quickly became one of his passions, and he went on to own some 9,000 cheetahs. Besides using them to hunt gazelles, Akbar was "very desirous that they should pair." He and his professional handlers tried everything to get the cats to breed. They even let some of them run free in the palace gardens, but to little avail. Only a single litter of three cubs was born.

It was not until 1956, more than 400 years later, that the Philadelphia Zoo managed to duplicate Akbar's feat of reproducing cheetahs in captivity. A trickle of births followed at other zoos, and over the next 30 years the North American collection increased to 200 animals. But a close look at the numbers showed that all was not well. Less than 15 percent of wild-caught cheetahs in the zoos were breeding, and almost 40 percent of the cubs born in captivity died soon after birth.

Considering all the advantages of modern husbandry techniques, this record was not a whole lot better than Akbar's. The cheetahs' dismal breeding situation spawned numerous high-tech studies of the cats' reproductive biology and genetics, which unveiled an incredible biological mystery but came up with few solutions to the problem. Biologists believe that ultimately the cheetah's survival will rest with old-fashioned protection and habitat management.

biologists look for high-tech solutions to the genetic problems of these graceful cats

Cheetahs have always been the oddballs of the cat world. Their high-shouldered way of walking, incredible sprinting ability, and gentle nature set them apart from all the other felids. Their long legs, slim body, and specialized claws have made them highly effective coursing hunters, and their spectacular chases after gazelles and wildebeests rank among the world's most amazing natural phenomena.

Although cheetahs mated and gave birth well enough in the wild, females in captivity rarely came into estrus and did not seem eager to mate. By 1980 the lack of breeding success had become an acute problem. International laws to protect spotted cats were making it difficult for zoos to import wild-caught cheetahs, and the captive population was not replacing itself. Frustrated breeders turned to the relatively new

By Fiona Sunquist
Photos By K.&K. Ammann

All around the euphorbia tree, the cheetah cub chases its littermate. Play behavior helps the youngsters become efficient predators.

In 1985 the researchers dropped their bombshell. Cheetahs, it appeared, were so genetically uniform, it was surprising they managed to breed at all. Blood samples from South African cheetahs showed them to be virtual clones, as genetically identical as specially bred laboratory mice. Males had low sperm counts compared with those of the domestic cat, and more than 70 percent of cheetahs' sperm were abnormal in some way. In the livestock industry, bulls are considered infertile if more than 20 percent of their sperm are abnormal.

The cheetahs' genetic uniformity was really brought home when biologists showed that it was possible to graft skin from one cheetah to another without the tissue being rejected. Skin grafts between unrelated humans are rejected within about ten days, but the cheetahs' immune system did not recognize the skin from an unrelated cheetah as being foreign, and so did not reject the graft. The chances of two individual animals being so genetically similar that they could accept each other's skin are fewer than one in 10,000.

Researchers speculated that all these genetic problems were a result of a population crash that occurred about 10,000 years ago, when the cheetah narrowly escaped extinction. The species' numbers slowly recovered from a mere handful of survivors, but in the process, generations of cheetahs had no choice but to breed with their close relatives.

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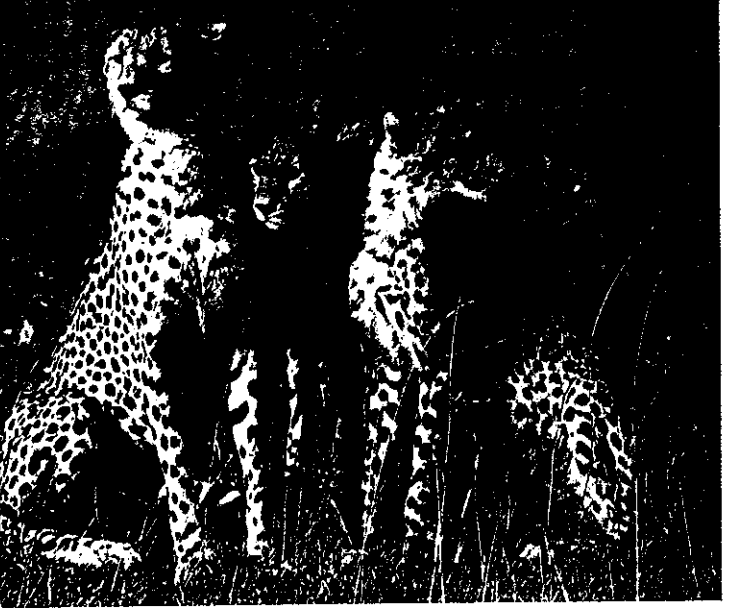
Normally, a population of several thousand mammals will contain an enormous number of gene forms. As individuals mate and reproduce, they pass on different gene combinations to their offspring. Every combination is unique. The population is like a boxcar full of millions of different colored beads, and each individual is made up of a handful of beads. There are infinite possible color combinations. If the container suddenly shrinks, there is no longer room for all the beads and there will be fewer potential color combinations in each handful. A population of animals reduced to a very small number contains only a tiny fraction of the genetic diversity of the larger population. It is like trying to pour the contents of the boxcar into a grocery bag—not all the beads will fit. The beads that make it into the bag are the surviving genes; the ones on the floor are out of the running. In scientific terms, this is known as a genetic bottleneck, and it results in fewer possible gene combinations, or genetic uniformity. This is what scientists believe happened to the cheetah.

The most serious consequence of this bottleneck may be the loss of genetic diversity in the cheetah's immune system. Zoos were already aware that cheetahs were very susceptible to diseases, but in 1982 an incident at the Wildlife Safari Park in Winston, Oregon, provided a graphic demonstration of the cats' vulnerability. Two cheetahs received on breeding loan sickened and died of feline infectious peritonitis soon after their arrival. Within six months, all 42 of the park's cheetahs showed similar symptoms and half of them subsequently died. The high number of deaths came as a surprise, because although all cats are known to be vulnerable to the virus, it usually kills only about one percent. When faced with such a viral challenge, the genetically uniform cheetahs are



clearly at a disadvantage compared with other cats. Indeed, after loss of habitat, increased vulnerability to diseases may prove to be the most serious threat to wild cheetahs' survival.

This tale of genetic woe appears to spell doom for the cheetah, but the news is not all bad. The cheetah is clearly a survivor. It escaped at least one near brush with extinction and subsequently rebuilt its population. No one has any idea how many wild cheetahs there were in Akbar's time, but there must have been a substantial number to sustain the offtake of the thousands that were captured each year for European and Indian nobility.

Above and below: All cheetahs, even those in different families, are so genetically uniform that they have a great deal of trouble successfully reproducing and adapting to new and changing conditions.

Furthermore, the cheetah is not the only species to have survived a genetic bottleneck. By 1892 the population of northern elephant seals had been reduced by hunting to a single group of about 100 off the coast of Baja California. After protective measures were instituted, the population grew; numbers are currently estimated at 100,000. Similarly, southern sea otters along the Pacific coast were hunted to near extinction, and by 1914 only 50 were thought to survive in central California. Protection resulted in a rapid increase in this population, which now numbers about 2,000. The Mongolian wild horse and Père David's deer, both considered extinct in the wild, have recovered from populations that were reduced to fewer than 20.

Thanks to advances in molecular biology and knowledge of cheetah behavior, we have increased our understanding of cheetah reproduction, but the question "Why are cheetahs so difficult to breed in captivity?" has not been fully answered. Researchers are focusing on two different approaches to that problem.

In 1991, two Texas institutions—Caldwell Zoo in Tyler and Fossil Rim Wildlife Center in Glen Rose—cooperatively produced a cheetah cub through artificial insemination. David Wildt predicts that "in two or three years we may be able to breed cheetahs in captivity [with regularity] through artificial insemination or in vitro fertilization." He speculates that some time in the not too distant future it may be possible to exchange genes between wild- and captive-cheetah populations, too. "We may be able to collect sperm from wild cheetahs in Africa, freeze it, and then use it to fertilize captive females."

But Wildt acknowledges that physiologists have little to offer in the way of solutions to the cheetah's long-term survival in the wild. "Our efforts are directed toward supporting the AAZPA Species Survival Plan for captive cheetahs," he says. (The Cheetah Species Survival Plan is one of 63 SSPs managed by the American Association of Zoological Parks and Aquariums to promote captive breeding of endangered and threatened wildlife.)

Other researchers are investigating the captive-breeding problem from a different angle. Armed with ten years of information that has been gathered from wild cheetahs in East Africa, Tim Caro, a biologist at the University of California at Davis, believes that some of the cheetah's breeding problems in captive situtations may be behavioral. "Physical features, such as large enclosures and elevated areas that allow the cats wide views, may encourage females to come into estrus. However, competition between males over mating rights and the ability of a female to choose a suitor may be even more important."

Nadja Wielebnowski, one of Caro's students, is currently investigating the importance of these different factors in three captive populations.

Despite their species' genetic problems, several thousand cheetahs survive on the savannas and grazing lands of Africa. Caro believes that protecting cheetah populations outside wildlife reserves and national parks will be critical to the future of the species, because, much to everyone's surprise, cheetah cub survival in protected areas is low. Recent studies by Karen Laurenson, another of Caro's students, have revealed that protection encourages increases not only in the number of prey but also in predators such as lions and spotted hyenas, which kill large numbers of cheetah cubs. Outside reserves, these other predators are often harassed themselves and live at lower densities.

"There is hope yet for cheetahs in multiple-use areas, as long as local pastoralists will tolerate the cats' presence," says Caro.

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Science writer and photographer Fiona Sunquist has been covering wildlife issues for more than a decade. Her articles have appeared in International Wildlife, Smithsonian, *and other magazines. She and her zoologist husband, Mel, are writing a book on the wild cats of the world.*

The Cheetah's Range—Past and Present

CHEETAH PROFILE

Scientific Name: *Acinonyx jubatus*

Physical Characteristics: This long-legged, slim-bodied cat stands about 30 inches at the shoulder and weighs from 80 to 150 pounds (males are generally larger than females). The cheetah has a rounded head, short ears, and round pupils. Its paws are relatively narrow, and its claws are slightly curved and only partly retractable—features that help it attain fast speeds over short distances.

Range and Number: Originally occurred from Palestine and the Arabian Peninsula to central India, as well as throughout Africa, except in the tropical zone and central Sahara. Has disappeared from most of Asia, except Iran and perhaps Pakistan, Afghanistan, and Turkmenistan. The African population is anywhere from 10,000 to 25,000.

Threats to Survival: Hunting, habitat destruction

Official Conservation Status:
- U.S. Endangered Species List—Endangered
- Convention on International Trade in Endangered Species—Appendix I, threatened with extinction
- World Conservation Union (IUCN) Red List of Threatened Animals—Vulnerable; Asiatic subspecies, *A. jubatus venaticus,* considered endangered