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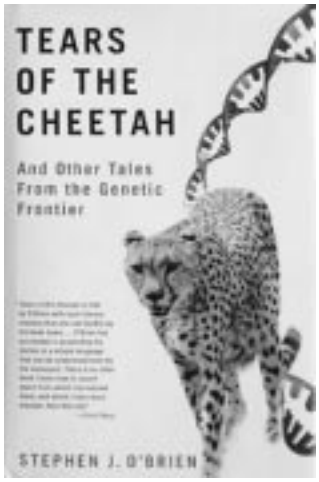
Abstract: Stephen J. O'Brien, chief of the Laboratory of Genetic Diversity at the National Cancer Institute in Fredericks, Maryland, is a specialist on the genetics of cats, domestic and wild. Chapter 2 of this book explains its title „Tears of the Cheetah". When zoos began breeding threatened species, the cheetah proved to be the most difficult. Laboratory studies of semen and blood led to a revelation - the sperm count in every cheetah was only 10 per cent of that of other cats, and many sperm were abnormal. The researchers found there was no variation at all in 50 cheetahs' allozyme genes. The unrelated cheetahs were genetically identical. They suffer a "bottleneck", a greatly reduced population, leading to inbreeding and therefore to genetic uniformity, some 12'000 years ago, a burden cheetahs still carry today.

Book Reviews

TEARS OF THE CHEETAH
And Other Tales
From the Genetic Frontier



by Stephen J. O'Brien
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pp. 286

As Chief of the Laboratory of Genomic Diversity at the US National Cancer Institute in Fredericks, Maryland, Stephen O'Brien might seem an unlikely specialist on the genetics of cats, domestic and wild. But, having decided that the study of the genetic evolution of species had great potential for the future of comparative medicine and biomedical applications, he chose the domestic cat as the mammal to map because it was afflicted with Feline Leukemia Virus (FeLV). His suspicion that the virus could influence cancer genes proved to be true, and over 100 of such genes were to be discovered in cats, with their counterparts in mice, chickens and humans. This provided a basis for the study of cancers and their treatment. With some 200 human hereditary diseases with counterparts in cats, this worldwide favourite species has proved more valuable as a laboratory model than the traditional mice and rats.

Nevertheless it is a chapter on mice that opens the book with the story of research on mice in California which revealed the source of a devastating virus that hit mice in China in the Middle Ages. The chapter sets a pattern for explaining scientific and technical terms which O'Brien maintains throughout the book, thereby greatly aiding the non-specialist reader.

Chapter 2 explains the title of the book, "Tears of the Cheetah". When zoos began breeding threatened species, the cheetah proved to be the most difficult. Cheetah breeders appealed for help. Mitch Bush, head veterinarian at the National Zoo in Washington DC and David Wildt from O'Brien's laboratory flew to South Africa to investigate the problem. Laboratory studies of semen and blood led to a revelation – the sperm count in every cheetah was only 10 per cent of that of other cats, and many sperm were abnormal.

The blood samples led the researchers to the cheetah's genetic make-up, where they found there was no variation at all in the 50 cheetahs' allozyme genes. Implanted skin grafts, which would be rejected by individuals unrelated to the original, were all accepted. The unrelated cheetahs were genetically identical. Further evidence came when Feline Infectious Peritonitis Virus (FIPV) killed 60 per cent of a zoo cheetah population, including 85 per cent of the cubs because they were, as O'Brien explains, "virtual immunological clones".

It's a fascinating story, well told, and further research led to the conclusion that cheetahs suffered a "bottleneck", a greatly reduced population leading to inbreeding and therefore genetic uniformity, some 12,000 years ago, a burden cheetahs still carry today. O'Brien suggests that the cheetah has survived because its "hermit lifestyle" protected it from spreading inevitable epidemics that would exploit their immune disease gene uniformity.

But then to lions. The Serengeti's 3,000 lions were found to have great genetic diversity, while the small population in the nearby Ngorongoro Crater had 50 per cent less overall diversity, having passed through a recent bottleneck. But away in the Gir forest of western India, the last surviving Asiatic lions, fewer than 300 descendants of a handful existing a century ago, were like clones or identical twins. Low sperm counts and high incidence of malformed sperms were causing serious breeding problems.

Lions, unlike cheetahs and other cats, have a close social society. O'Brien asks whether they have evolved an immune system shield that fills the defensive void of genetic homogeneity – or could a new disease lead to their extinction any day?

More has been spent on saving the Florida panther, a race of puma, than on any other threatened species in relation to the total population – fewer than 40 in the 1970s, now about 80. When O'Brien and his colleagues studied the genetics of the survivors they found that those in the Everglades, but not those in Big Cypress Swamp, had genes from Costa Rican pumas. Research in old files of the Everglades National Park Ranger's Office found that the state government had permitted a release of pumas from a zoo, whose director was rumoured to have bred Florida panthers with some from elsewhere. He never admitted it, but the genetics research provided the evidence. The consequence was that the Everglades' panthers had received fresh genes which saved them from the effects of inbreeding shown in Big Cypress Swamp panthers – kinks at the end of the tail, cowlicks (mid-dorsal whirls on the back of the neck), and cryptorchidism (failure of one or both testicles to descend to the scrotum, which reduces sperm production).

One of the later measures to save the panther was to temporarily introduce female Texas cougars to breed with panthers in Big Cypress Swamp in order to augment the panthers' genetics. Meanwhile the last Everglades female died, probably because of mercury poisoning; two of the last males headed for Big Cypress Swamp to find mates and the third stayed with no breeding prospects.

Like those of the cheetah and the lion, the Florida panther story (much more than described here) is gripping. But O'Brien goes on to recount research on whales, orang-utans and giant pandas before discussing human genetics, including AIDS and HIV.

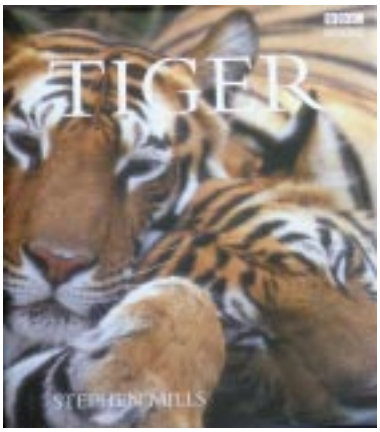
And in another remarkable story O'Brien describes how he and his colleagues were able to pin a murder on a Canadian from analysis of the hair of a pet cat. Despite doubts by NIH administrators whether O'Brien and his lab should be involved in the case, approval was finally given. It marked a legal precedent for DNA profiling of animals.

While clearly the leader, O'Brien showers warm praise on his named colleagues for their crucial contributions to the genetic studies.

Truly a masterpiece. O'Brien's book is exciting and beautifully written, deserving the high praise on the dustcover by eminents, such as Ernst Mayer (who wrote the foreword), Richard Leakey, Erik Lander, Robert Gallo and Thomas Lovejoy.

Peter Jackson

Tiger



by Stephen Mills
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No other animals attract readers, and therefore writers, like tigers. There are shelves of lavishly illustrated books on the great striped cat. But Stephen Mills' "Tiger" bids to outclass them all. As scientist, film-maker and writer, and obsessed with the tiger, Mills has produced a magnificent review of the tiger as a wild animal, the changing world it has been forced to live in, and its prospects for survival.

The opening chapters follow the standard formula of describing the tiger as hunter, its prey, its courtship and mating, and its family life, all written with great knowledge and insight. But then Mills tackles the big issues – are tigers sociable or solitary; is their behaviour changing because of human pressures; man-eating; how can we find out how many tigers there are; what needs to be done to ensure their survival in a dangerous future? Mills's discussion of these issues is outstanding.

In the old days most of our knowledge of tigers rested on the tales of hunters, not least the famous Jim Corbett, and featured India. Although groups of tigers were occasionally seen, it was generally accepted that they were solitary. Experience of males killing their own cubs in the cramped environment of zoos led to the assumption that it happened too in the wild. Tigers were seldom seen except when attracted by baits. This remained true even into the 1970s, the dawn of tiger conservation with the launch of Project Tiger in India.

Now renowned, Ranthambhore in Rajasthan was one of the first nine dedicated tiger reserves, and there in the early 1980s Valmik Thapar and Fateh Singh Rathore began to see tigers by daylight and at close quarters. Tigers were showing a confidence never witnessed before. Thapar and Rathore's first books, with their black and white photos of tigers and their family life were a sensation. Ranthambhore became a Mecca for people wanting to see tigers in the wild. It also attracted film-makers, and Stephen Mills was one of them. The close observation and research that filming involved, together with experience when leading tour groups, provided Mills with exceptional personal knowledge of the tiger in India and Nepal.

In the early 1970s, the first tigers were radio-collared in order to track their movements in Nepal's Chitwan National Park. This led to understanding of the basic social structure of tiger populations. As Mills explains, tigers are both social and solitary. Tigers, including males, know their relatives and associate with them, while their forest habitat makes hunting for food, which dominates their lives, a solitary affair.

While tigers are generally tolerant in their extended family, they are aggressive towards strangers, particularly males. But Mills notes that most tiger populations are now small and isolated, and there is a general tolerance. There are strong grounds for his speculation that such populations have become tolerant because they are almost all related, in fact extended families.

"Tiger" and "Maneater" have long been almost synonymous. But the question why tigers attack people, has changed to why they usually do not. Horrifying numbers of people reported killed by tigers appear in Indian records up to and including the era of Jim Corbett. But in those times there were tens of thousands of tigers, while many reported deaths may not have been the result of tiger attacks, but perhaps murders or just disappearance. People have always lived close to tigers – early radio-tracking revealed a tigress and cubs living in tall grass on the outskirts of a Chitwan village, whose people passed close by and had no idea they were there. In these days many people pass unharmed close to tigers. Attacks do occur, and there are determined maneaters, but they are often the result of unexpected confrontations and a defensive attack. Mills tells of personally tense moments, but it seems that he and other humans are not viewed as food by most tigers.

How many wild tigers are there? We don't know, and never shall exactly. India's pugmark counting method has been discredited, although experts in the Russian Far East have used tiger tracks in winter snows to arrive at reasonable population estimates. New methods, such as phototrap images from which statistical estimates of densities within research limits can be made, are now carried out, but they contribute little towards overall estimates of numbers. Mills agrees that, for now, we are left with world figures in the 5,000-7,000 range, based largely on local "guestimates".