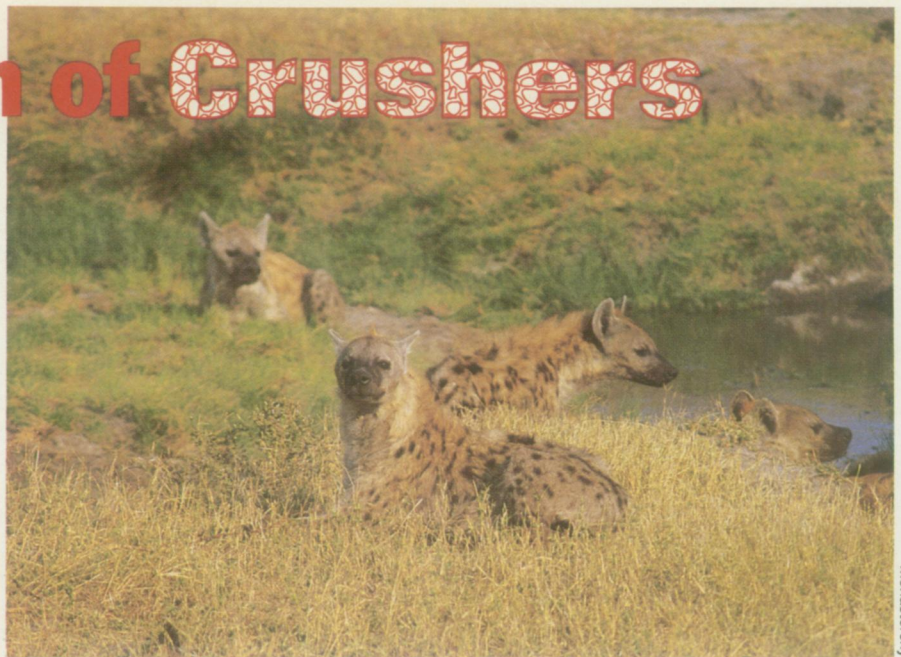


A Question of Crushers

*Why animals
throughout history
have developed
a taste for
bones*

By RICHARD MONASTERSKY



Monastersky

Best known as a cowardly scavenger that scrounges leftover carcasses, the hyena's reputation ranks about equal with that of, say, a pickpocket. The carnivore's maniacal laugh and brooding posture do nothing to improve its image. The hyena appeals so little to the general public, in fact, that relatively few zoos around the world bother to exhibit this king of carrion.

But to paleontologist Larry D. Martin of the University of Kansas in Lawrence, the hyena's scavenging habits raise an intriguing evolutionary question that reaches back through some 30 million years of mammalian history. Although hyenas are skillful hunters and often kill live prey, they have for some reason developed a body specialized for crunching through bone — a relatively non-nutritious source of food.

Hyenas are not alone in this. Looking back in the fossil record, Martin sees numerous examples of extinct mammals sporting the robust teeth and jaws necessary for cracking open carcasses. That history leads Martin to wonder why carnivores from vastly different families have time and again turned to dining on bone.

The answer may relate indirectly to variations in Earth's climate and the strength of seasons, Martin proposed in October at a meeting of the Society for Vertebrate Paleontology in Albuquerque, N.M. For some periods in the past, most of the continents had equable weather all year round, with little difference between winter and summer. Other times had a climate more like today's, with seasons swinging between warm and cold in the mid-latitudes and wet and dry in the tropics. For animals living through such a boom and bust cycle, says Martin, the capacity to reach marrow inside a bone may mean the difference between life and death.

In developing this theory, Martin credited his research on human diets conducted by anthropologist John D. Speth of the University of Michigan in Ann Arbor. Speth gleaned his first insights about diet while excavating a series of prehistoric deposits in southeastern New Mexico that contained the bones of bison butchered around 1450 A.D. The remains puzzled Speth because the ancient hunters displayed a peculiar appetite: They left most parts of the female bodies to rot at the butchering site yet lugged home as much

of the male carcasses as they could carry.

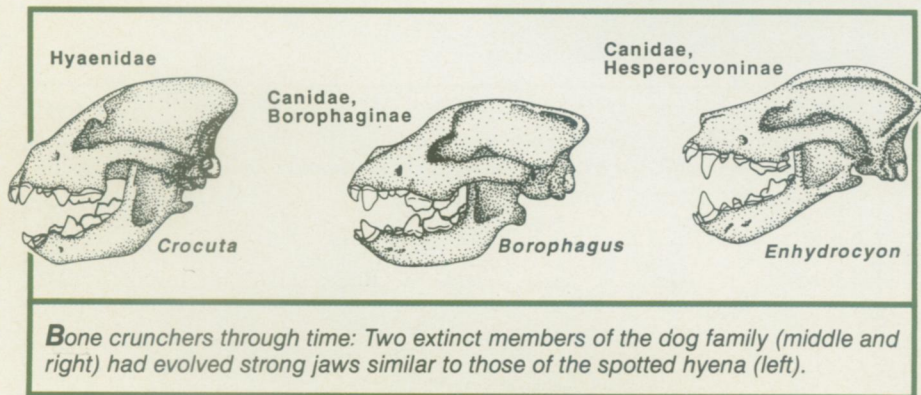
What was wrong with the female bison, Speth wondered? The only clue was the season of the bison hunt. Although most known prehistoric bison kills happened in fall and winter, the New Mexico site contained animals killed in springtime. Speth consulted the literature on wildlife research to understand what could make female animals so unappetizing during that season.

The answer turned out to be fat — or rather, a lack of it. "The wildlife literature said what was obvious in hindsight, that pregnant and nursing cows are often severely stressed in the spring because they are carrying a full-grown fetus or nursing a newborn while the forage has yet to start growing. So they live off their fat reserves and get fat-depleted," says Speth.

When animals start to starve during cold or dry seasons, their body fat can drop to only a few percent of their total weight. That's far less than what appears in even the leanest cuts of steak. A diet made up of almost pure protein contains too few calories and leads to protein poisoning, says Speth, which may explain why the hunters rejected the extremely low-fat meat of the female bison.

Searching through more recent accounts, the anthropologist found a similar concern about the quality of meat during harsh seasons. For instance, members of the Lewis and Clark expedition made references to the inadequacy of lean meat, as did the lore of American Indians, says Speth. Hunters in various societies from North America to Australia often abandon fat-depleted meat, even at times of food shortage.

Speth recounts one extreme example in which a military officer named Randolph Marcy ran out of food in southwestern Wyoming during the winter of



Bone crunchers through time: Two extinct members of the dog family (middle and right) had evolved strong jaws similar to those of the spotted hyena (left).

Martin

1857-1858. He marched his men all the way to Santa Fe, N.M., to find provisions. They survived the trip by eating their pack animals, but the poor quality of the meat nearly killed the men.

In his account of that journey, Marcy wrote: "We tried the meat of horse, colt, and mules, all of which were in a starved condition, and of course not very tender, juicy, and nutritious. We consumed the enormous amount of from five to six pounds of this meat per man daily, but continued to grow weak and thin, until, at the expiration of twelve days, we were able to perform but little labor, and were continually craving for fat meat."

To Martin, Speth's findings about human hunters seemed to crack open the mystery of bone crushing among animals.

"If you are a predator and for some reason your prey is in very poor condition for part of the year, then you will greatly increase the value of the meat that you have if you can get some fat with it. And the last reservoir of fat in an animal in bad condition is in the bone marrow. So for the hyena, it winds up being a food multiplier," says Martin.

As a paleontologist who specializes in studies of North American mammals, Martin knew that the ability to crush bone had evolved several times on this continent among independent lineages of extinct carnivores. All of these animals had characteristic skulls advertising their peculiar dining habits. They tended to have short snouts and high foreheads, with jaw muscles attached farther up on the skull for increased bite force. They had thick, strong lower jaws, set with large, sturdily constructed teeth. The tops of the teeth were generally worn flat.

Animals bearing such powerful jaws have come and gone at least a half-dozen times during the 65 million years since dinosaurs died out and left the continents under the dominion of the mammals. Bone crushers first appeared among the creodonts, the first order of mammals to take over the land. After they went extinct, similar features appeared on an early dog-like creature named *Enhydrocyon*, which lived 25 million years ago.

Enhydrocyon and the rest of this subfamily of canids eventually disappeared, but a separate line of dogs evolved some 5 million years ago. Among these was an animal called *Borophagus*, which so resembled the modern hyena that it was originally classified as one. To a lesser extent, several other types of ancient mammals, such as the dire wolf, have also displayed the reinforced skull of a habitual crusher.

Among living species, the hyena — especially *Crocuta crocuta*, the spotted hyena — best manifests the characteristics of an animal adapted to opening bones. Despite their reputation as meek

scavengers, hyenas actually obtain much of their food by hunting live prey. Working in packs, they can be fierce fighters and have been known to kill adult lions. Although dog-like in appearance, hyenas are actually not related to the canids. They are more closely linked to cats and share the closest ancestors with the viverrids, the family that includes mongooses and civets.

Like the hyena, most earlier bone crushers had bodies well suited to running, and they could certainly have caught live prey, Martin says. They probably did not diet solely on bones but rather used this food source as a supplement, especially during winter. Because of their ability to reach the fatty marrow, bone consumers have a distinct advantage when seasonal climate reduces the nutritive value of prey, Martin proposes.

If he is correct, then hyenas and their

ancient look-alikes should have appeared during periods when the planet had strongly varying seasons, cycling from months of feast to those of famine. Although he plans to examine this question more carefully in the future, Martin says preliminary studies of the fossil record seem to support that general pattern.

"The [bone crushers] appear in periods that were drier and probably more seasonal, and they persist into the next period after that and become extinct. Then you get another bone crusher appearing later in a new period of severe conditions."

Martin's theory thus paints a different picture of hyenas, one a bit more noble than their usual image as a contemptible scavenger. Indeed, they emerge as highly specialized creatures — evolution's answer to the problem of making a living in an unforgiving climate. □

Life among today's bone crushers

Walking across a parched savanna in northern Zambia, Maxon Phiri stops abruptly and points to a white lump on the ground. "What do you think that is?" he asks, rolling the object with the toe of his shoe.

In shape, it resembles the torpedo-like droppings of a lion or some other carnivore. But this one has the hue of pure snow, without a speck of color. Phiri, a wilderness guide in the South Luangwa Park, picks up the mystery item and uses it like chalk to write his name on a wooden box.

"It's from a hyena," Phiri finally explains to a group of bewildered hikers. "When hyenas eat bones, it makes their droppings white — filled with calcium."

Built like an overdeveloped weight lifter on steroids, the hyena has evolved a body designed to make the most out of carcasses. With its forceful jaws and strong teeth, hyenas can easily rip off

limbs and crush through the densest bone. But these carnivores are also adept predators.

A few days later, a group of park visitors comes upon a pack of hyenas devouring a wildebeest in the waning afternoon light. At first, only the sound of tearing flesh and crunching bone breaks the silence. Then one brazen young hyena runs up and steals a leg, carrying it off for a private feast. That cheeky act triggers a round of high-pitched shrieks that, in some eerie way, resemble human laughter.

The wildebeest body is lying in a shallow puddle, so the hyenas have faces painted with a mixture of mud and blood. One of the larger animals lumbers away from the carnage, its belly swollen from the meal. It drops to the ground, rolling over with legs sticking straight up in the air as if to say, "I've had enough and want a nap."
— R. Monastersky

