

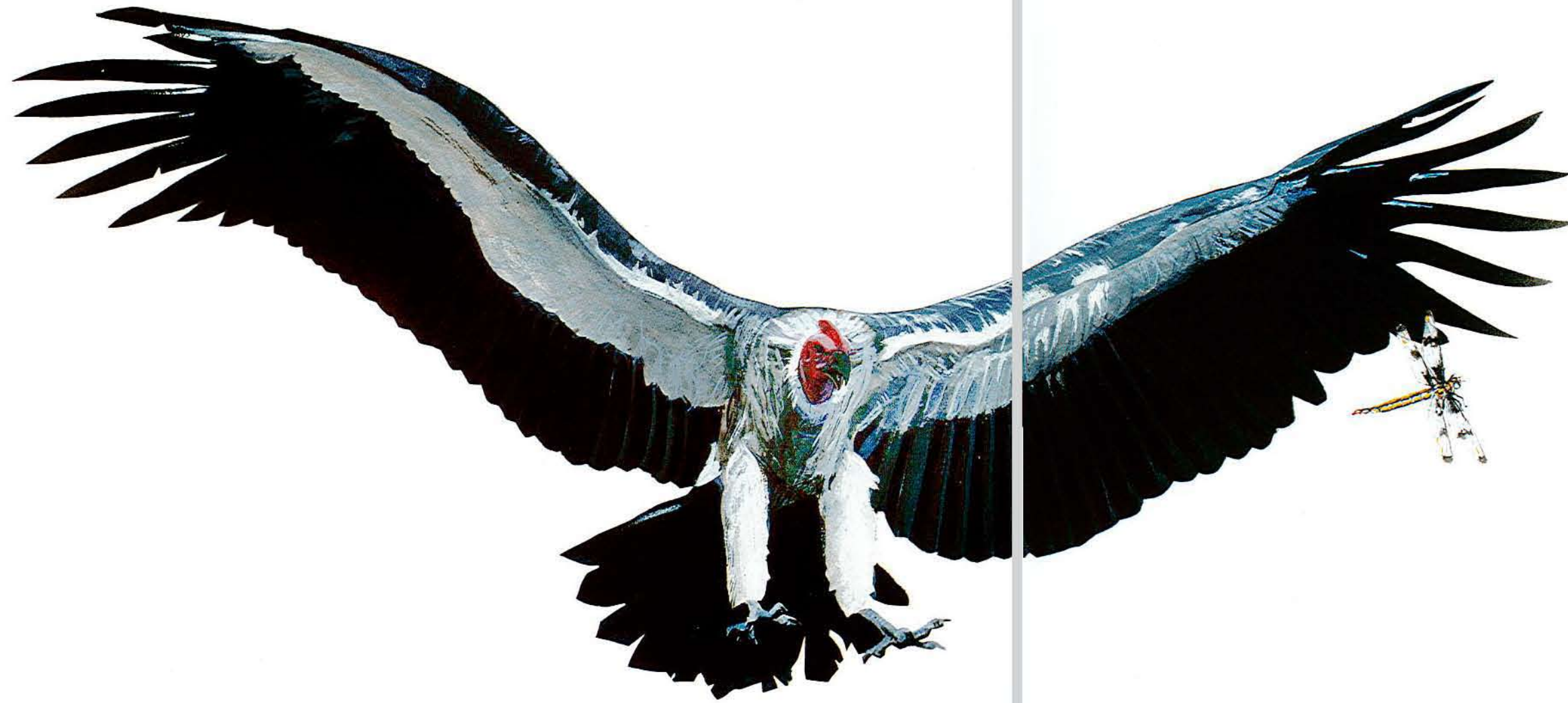
GIANTS



OF LAND, SEA & AIR · PAST & PRESENT

DAVID PETERS

A SIERRA CLUB BOOK



DAVID PETERS

Alfred A. Knopf  New York

Sierra Club Books • San Francisco

GIANTS

of Land, Sea & Air.

Past & Present

To all the scientists, authors, and illustrators that came before, I now see farther because I have stood on the shoulders of giants.

The author's special thanks to:

Dr. Kevin Padian, Department of Paleontology, University of California at Berkeley, for reading the manuscript and helping so generously; Danny Moses and Diana Landau at Sierra Club Books and Dinah Stevenson and Jenny Fanelli at Alfred A. Knopf.

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Book design by Mina Greenstein

Library of Congress Cataloging-in-Publication Data Peters, David. Giants of land, sea & air, past & present. Includes index. Summary: Discusses body size in the animal kingdom and depicts giants from past and present, both individual specimens and those belonging to large species such as the prehistoric giants. Includes gatefold pages showing the very largest animals. 1. Animals—Miscellanea—Juvenile literature. 2. Extinct animals—Miscellanea—Juvenile literature. 3. Body size—Miscellanea—Juvenile literature. [I. Title. II. Title: Giants of land, sea & air, past & present. QL49.P39 1986 591.4 86-2719 ISBN 0-394-87805-1 ISBN 0-394-97805-6 (lib. bdg.)

0 9 8 7 6 5 4 3 2

Cover illustration: sperm whale

Manufactured in Singapore

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INTRODUCTION

This is a book about giants—about many of the biggest animals ever to inhabit the earth's land, seas, and air. The giants are grouped according to either type or shape so that their similarities, differences, and peculiarities can easily be seen.

All of the illustrations have been drawn to the same scale (1 inch = 22½ inches). If you hold the book 18 inches from your eyes, the illustrations will seem the same size as the actual animal would seem when viewed from a distance of 33¾ feet. Even with the facts and figures in front of us, it can be difficult to realize how immense these creatures are or were, and so every two-page spread includes an illustration of an average-size adult human couple drawn to the same scale.

Of the living animals, only the largest single individuals on record have been pictured and described in this book. Encountering such giants—especially the marine animals—would be a rare or once-in-a-lifetime experience. However, for the prehistoric animals, the size estimates probably represent an average for the species. The odds against finding an abnormally gigantic specimen in fossil form are rather high because so few bones become fossils and so few fossils ever see the light of day.

The appearance of the prehistoric animals has been re-created by scientists and artists on the basis of several kinds of evidence: fossil skeletons; footprints; feather, scale, and skin impressions; cave paintings; and the actual frozen bodies of some Ice Age types. Educated guesswork by scientists as they piece together the remains, following the body plan of living animals, produces models and drawings of what the animal *may* have looked like. Not all scientists agree on how the evidence should be interpreted. The drawings in this book are based on a number of different sources and views.

Each animal has two names, a common name that everyone uses and a Latin name with which scientists describe it. Many prehistoric creatures have no common name and so only the Latin one is used. Under each headline in this book, the Latin name (in italics) is in two parts, indicating the genus and the species of the giant described in the text. The remaining words (separated by dots) identify the animal's order, class, and phylum, the main branches of the family tree of the animal kingdom.

There are two kinds of giants.

Some are individual creatures that during their lifetime grew abnormally large for their species.

This condition is known as gigantism and, in mammals, it often arises from an overactive pituitary gland. This gland releases the hormones necessary for growth and other bodily processes. Fish, amphibians, reptiles, and some mammals, such as the elephant, may grow continuously throughout their lives, and so giants of these species are usually old individuals. Disease, inadequate food supply, inadequate defense against predators and parasites, the loss of the last set of renewable teeth, and accidents may shorten the life of these animals, limiting the species' potential size.

Other creatures are, by nature, just plain huge. These giants are the species that have evolved slowly, the end product of countless generations, each a little larger than the generation preceding it.

The process of evolution sometimes favors the development of ever larger individuals. Mating privileges are often won by the biggest and strongest male or the one with the largest horns, antlers, or tusks. And this male is likely to pass his genes on to a greater number of offspring than his rivals. These offspring in turn may produce generations of ever larger individuals, each one a little better able to defend itself and exploit its environment than its competitors.

Large, healthy animals have a greater chance to reproduce because they stand less chance of being attacked. Predators are more likely to attack the smaller, weaker members of a herd, weeding out the sick and infirm because they make an easier kill.

Environment, too, plays a role in the development of giants. When living conditions remain favorable for long periods of time, animals tend to thrive. But when a stable environment is upset by drastic weather changes, cosmic catastrophes, loss of living space, the evolution of inedible food, or the introduction of more successful predators, the highly specialized giants are likely to be the first to disappear. No one knows why the dinosaurs died out 65 million years ago, but one theory suggests that all of the above, to a greater or lesser degree, occurred simultaneously over a 10-million-year period and killed off all the giant animals on the earth. Today, Africa's living giants—the gorilla, elephant, and rhinoceros—are finding their chances for survival diminishing rapidly as civilization takes over more and more of their homes.

Bigger animals stay warm more easily than

smaller ones. In order to stay quick and alert, animals must keep their internal systems within a fairly narrow temperature range. A small animal's internal organs are just inches from the variable outside air temperature. But a large animal's vital organs may be buried many feet deep within the insulating bulk of its own body. Like elephants and whales, the bigger dinosaurs maintained a fairly constant and efficient body temperature simply by being so large. They stored the day's heat deep within their huge bodies, radiating little of it away throughout the chilly night. Whales are insulated from the bone-chilling polar seas by the sheer bulk of their immense blubber-clad bodies.

Sea creatures are free of one major thing that limits the size of land creatures—gravity. The weight of an animal increases as it grows three-dimensionally: taller, wider, and deeper. But the support of the legs can only increase in two dimensions, width and depth, and bone is not strong enough to take the strain after a certain point. Sea creatures are about as dense as seawater and so are buoyed up by the sea itself. Some have even added weight to insulate and streamline their bodies.

In the air, excess weight is a hindrance. The largest flying birds and reptiles were hollow-boned soarers with gigantic wingspans that could catch rising air currents and fly to great heights with a minimum flapping of their wings.

Many times in the history of life, giants have had the advantage. But after humans entered the

scene, being big became a detriment to many species. Humans were cunning enemies that hunted in packs, used weapons and traps, and valued the largest animals in order to store up food reserves, trade the surpluses, and increase their status within the tribe. Giant animals today must compete with the ever-growing human population for the last of the wild lands remaining to them.

Most of the animals in this book lived and died before modern humans evolved. Some animals became extinct during our early years on this planet. Others may disappear in the near future unless we decide they are too valuable and too wonderful to lose.

This book is not all-inclusive. Some incredibly huge creatures (such as the alleged 200-foot giant octopus) have not been included because their existence has not yet been proved beyond a reasonable doubt. Others are known to have existed, but the available evidence (single bones) is so limited that we can't begin to guess at their appearance.

New giants will continue to be discovered in the future as fossils continue to be unearthed and the remains of seagoing giants occasionally wash ashore from the ocean's depths. Some of the biggest animal giants to ever grace this earth have been discovered only recently. These discoveries are forcing scientists to reevaluate their assumptions about the natural limits of life on the earth. In other words, there's a lot more to be learned about giants.

GIANTS

of Land, Sea & Air • Past & Present

Human

Homo sapiens • Primates • Mammalia • Chordata

The tallest living primates, modern humans evolved in Africa at least two million years ago. With wide variation, adult males average 5 feet 9 inches in height. The average weight is 162 pounds. Females are usually shorter and lighter. The tallest man reliably measured grew to a height of 8 feet 11 inches and weighed more than 400 pounds. The heaviest man reliably measured weighed 1,069 pounds but was less than 6 feet tall.

Unlike other primates, which include monkeys and gorillas, humans stand erect and have virtually naked skin. A number of skin colors and hair textures occur among the races. Humans eat both plants and animals.

Humans have lived for as long as 120 years, but 70 is the modern average. They mature sexually at about age 12. Gestation is 9 months. Babies are born helpless and generally weigh 6 to 10 pounds at birth.

Humans are not particularly fast or ferocious, but they are the most intelligent of all animals and have become skillful tool and weapon makers. They organize themselves into societies, constructing elaborate shelters and cities as well as complicated devices that enable them to travel faster, fly higher, and swim deeper than any other animal. They were the first animals to walk on the moon.

Gigantopithecus

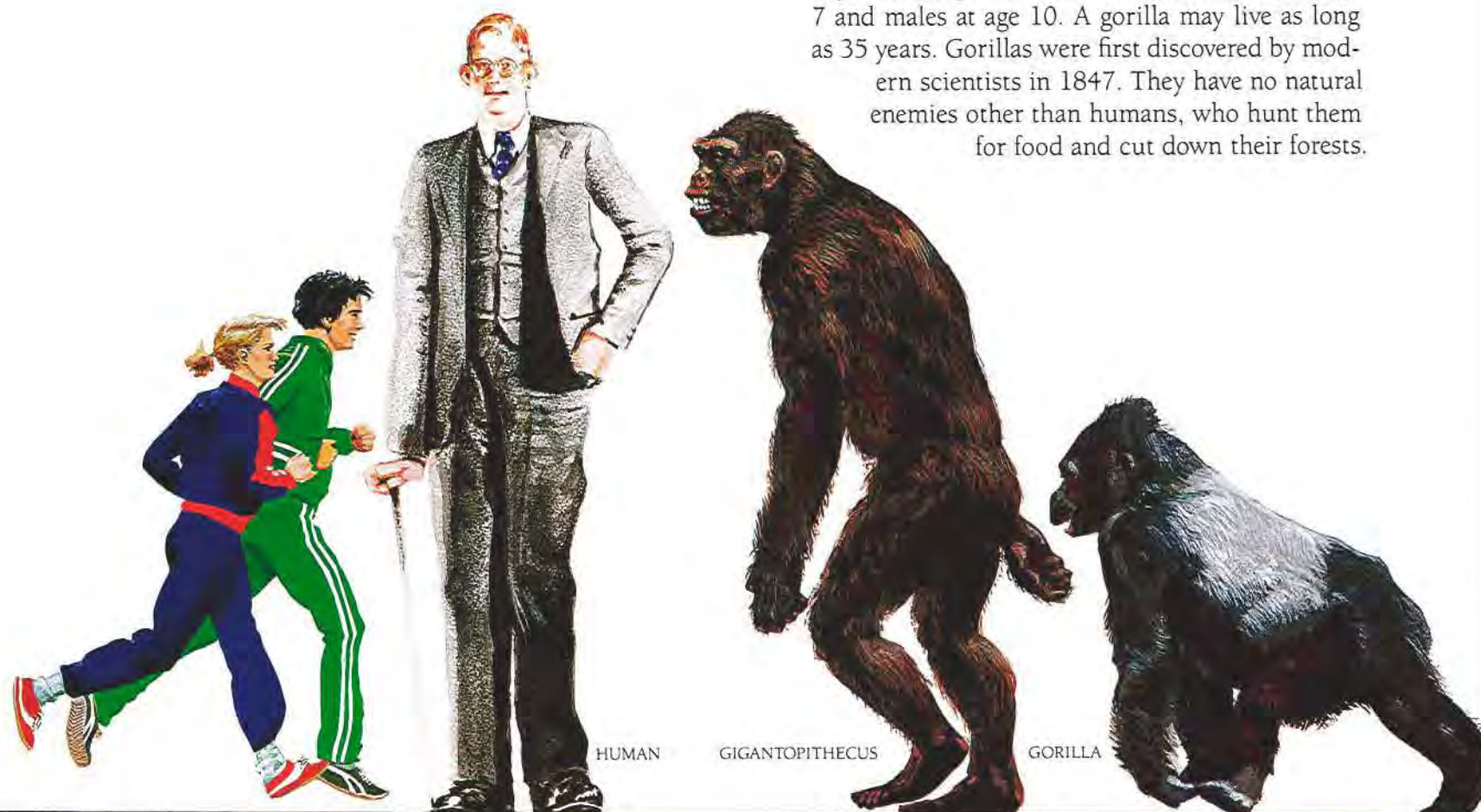
Gigantopithecus blacki [extinct]
Primates • Mammalia • Chordata

Gigantopithecus (jie-gan-toe-PITH-uh-kuss) was a ground-dwelling plant eater of the Himalayas during the Pliocene (two million years ago) in India and the Pleistocene (500,000 years ago) in China. Known only from fossil teeth and jawbones, this primate was not an ancestor of humans but was similar to them in some ways. The largest *Gigantopithecus* jawbones are larger than those of any known gorilla yet are shaped like those of a human, with small canine teeth and a rounded chin. From the size of the jaws, scientists have deduced that, standing upright, *Gigantopithecus* was 8 feet tall, with a probable weight of 600 pounds. Males were considerably larger than females. Some people who believe in the existence of the elusive "abominable snowman" suggest that it may be a form of *Gigantopithecus* still living today.

Gorilla

Gorilla gorilla • Primates • Mammalia • Chordata

The gorilla, on the average, is the largest of living primates, measuring up to 6 feet 2 inches tall and weighing up to 683 pounds. Males typically weigh 450 pounds. Females are always smaller. Gorillas live in tropical rain forests in western Africa in societies of from 2 to 30 individuals. They are nomadic and eat 30 to 40 pounds of fruit, vegetables, and meat that they forage each day. Female gorillas reach sexual maturity at age 7 and males at age 10. A gorilla may live as long as 35 years. Gorillas were first discovered by modern scientists in 1847. They have no natural enemies other than humans, who hunt them for food and cut down their forests.



Andrewsarchus

Andrewsarchus mongoliensis [extinct]
Carnivora • Mammalia • Chordata

Andrewsarchus (an-drooz-AR-kuss) was named for Roy Chapman Andrews, the famous fossil hunter. Probably measuring over 6 feet tall at the shoulder and 16 feet long, this primitive, wolflike predator may have been the largest meat-eating land mammal ever. Because only a 3-foot-long skull of this giant has been found, guesses about the rest of its body are based on the appearance of smaller, better known, related species with similar skulls.

Although related to the doglike carnivores of the period, huge *Andrewsarchus* may have moved about more slowly, like a modern bear. To support such a big skull, *Andrewsarchus* must have had a strong neck. Like others of its kind, it may have had a deep, heavily muscled chest supported by forelimbs ending in rounded nails, unlike the sharp claws of almost all other meat-eaters. Lacking claws, *Andrewsarchus* may have been a carrion eater. Some scientists think it fed on tough vegetable matter.

Its powerful jaws were filled with huge teeth capable of tearing flesh and crushing anything from bone to mollusk shells. The snout was long and narrow, like a wolf's, but it broadened immensely at the cheekbones. Judging by the skull, the muscles that worked the jaws must have been enormous. *Andrewsarchus* lived 40 million years ago during the late Eocene epoch. Its fossil skull was discovered in Mongolia and described in 1924.

Kodiak Bear

Ursus arctos • Carnivora • Mammalia • Chordata

This subspecies of the wide-ranging brown bear is found only on Kodiak Island, off the Alaskan coast. It is the largest meat-eating land mammal alive today. A male may be up to 10 feet long from nose to tail and weigh up to 1,656 pounds. The average Kodiak bear is 8 feet long, stands 4 feet 4 inches high at the shoulder, and weighs 1,175 pounds. Females are always smaller. At birth the young are rat-sized and helpless.

Unlike other carnivores, bears will eat plants as well as meat, and the Kodiak bear may eat 20 pounds of fish, small animals, plants, and honey each day. Despite its tremendous size and its huge claws and teeth, the Kodiak does not tackle large prey. It is not typically aggressive, but it can be extremely dangerous when provoked. A Kodiak may rise on its hind legs and shuffle toward an opponent in an awesome display, but unless it is cornered or is protecting its young, it will probably flee. Kodiak bears usually live less than 30 years in the wild. They have no natural enemies but humans.



African Elephant

Loxodonta africana

Proboscidea • Mammalia • Chordata

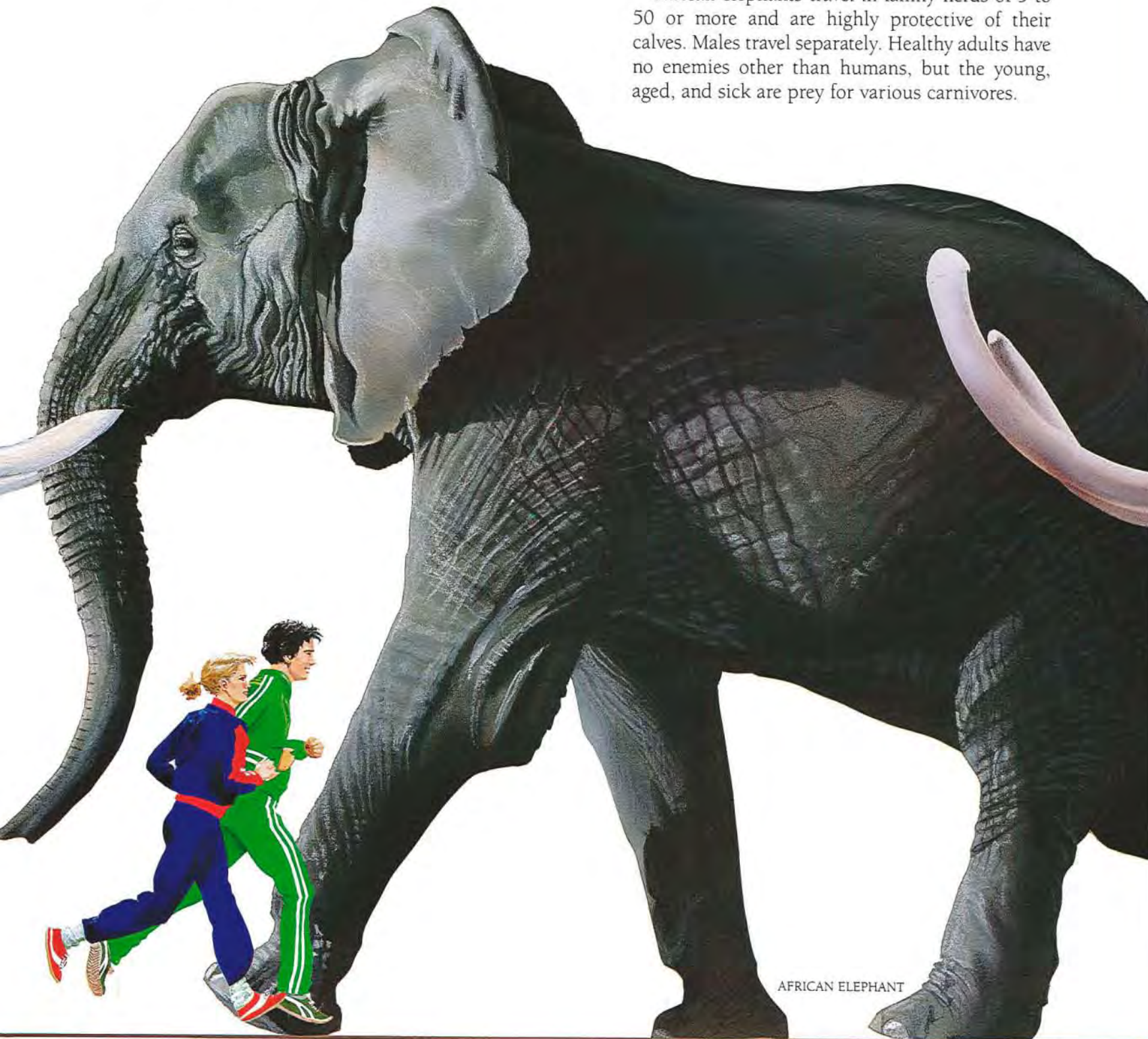
The largest living land animal is the African elephant. Males, called bulls, may measure up to 13 feet 2 inches tall at the shoulder and weigh nearly 27,000 pounds, but they average 11½ feet tall and 14,000 pounds. A prehistoric *Loxodonta* measured more than 14½ feet tall at the shoulder, making it the largest of all elephants.

The African elephant's ears are up to 4 feet wide, the largest ears in the world. This animal also has the largest teeth: tusks that grow up to 8 feet long and may weigh 80 pounds each. Its trunk, which is 6 feet long and weighs 300 pounds, is an especially sensitive "nose" that can

also pick up small or large objects and hold 1½ gallons of water. The elephant's huge skull is thick but not solid; an extensive network of air holes makes it lightweight. On the soles of the elephant's feet is a thick spongy material that cushions each step.

Elephant calves are born after a 20- to 22-month gestation, the longest in nature. They are 3 feet tall and weigh 200 pounds at birth. Although elephants continue growing throughout their lives, after age 60 their molars are no longer renewed. Lacking the ability to chew their food, they starve to death. An adult consumes up to 600 pounds of grass, leaves, branches, and bark and up to 50 gallons of water each day. Elephants are good swimmers.

African elephants travel in family herds of 5 to 50 or more and are highly protective of their calves. Males travel separately. Healthy adults have no enemies other than humans, but the young, aged, and sick are prey for various carnivores.



AFRICAN ELEPHANT

Woolly Mammoth

Mammuthus primigenius

[extinct]

Proboscidea • Mammalia • Chordata

The woolly mammoth reached a maximum height of 14 feet at the shoulder, but averaged only 11 feet tall. This Ice Age elephant was covered with a thick layer of fat and a heavy coat of shaggy fur. The enormous curved tusks that grew up to 16 feet long and crossed in front were used as snow plows to uncover mosses and grasses. Twigs of conifers, willows, birches, and alders have been found in the stomachs of frozen mammoth carcasses. The woolly mammoth built up food supplies in the form of a hump of fat on its shoulders to help it survive the long, cold winters.

Mammoths first appeared in India during the

Pliocene epoch, three million years ago. During the Pleistocene Ice Age, one million years ago, woolly mammoth herds crossed the land bridge from Siberia to North America. Mammoths were hunted and held in awe by the primitive humans living among them. Some European cave paintings depict the woolly mammoth as the artist saw it in life. The last mammoth died out only 10,000 years ago. Frozen flesh and bones were first discovered by scientists in 1799.



WOOLLY MAMMOTH

Arsinoitherium

Arsinoitherium zitteli [extinct]
Embrithopoda • Mammalia • Chordata

Arsinoitherium (ar-suh-noy-THEE-ree-um) lived from 35 to 28 million years ago during the Oligocene epoch in Northern Africa and China. It was named for Arsinoe, an Egyptian city near the area where its fossils were discovered in 1900. *Arsinoitherium* was 11 feet long and 5½ feet high at the shoulder. It had four horns on its head, two massive ones in front and two smaller ones farther back, above the eyes. The male's front horns were long and sharp; the female's were shorter and rounder. Although ferocious looking, *Arsinoitherium* was a sluggish, plant-eating swamp dweller. It is rather distantly related to the elephant family despite its superficial resemblance to the rhinoceros. *Arsinoitherium* is the only member of the entire order of Embrithopoda yet discovered, and so far has no predecessors or ancestors in the fossil record.

Brontotherium

Brontotherium platyceras [extinct]
Perissodactyla • Mammalia • Chordata

Brontotherium (bron-toe-THEE-ree-um) was the largest of the brontotheres (also known as titanotheres), a line of mammals that developed from the same tiny ancestors as our modern horse from 50 to 25 million years ago during the Eocene and Oligocene epochs. *Brontotherium* grew to 15 feet in length and was 8 feet high at the shoulder. It had a very small brain encased in a huge skull and a broad, two-pronged horn above its nose, longer and broader on the male. The horns seem to have been used in ramming contests, as some of the fossils of the adult males have broken ribs that appear to have been bashed in just such a way. The animal's legs were short and its skeleton massive. Although the leg bones were nearly solid to support the weight of the animal, the skull was like a hard sponge, filled with tiny air holes that lightened it. An elephant's skull is much the same.

As a grazing animal, *Brontotherium* would have had trouble cropping grasses with its weak front teeth and so may have had a prehensile lip and/or a long tongue to help tear the grass out of the ground. *Brontotherium* fossils have been found in great numbers throughout midwestern North America and in Asia and Europe, where the animal ran in herds.

White Rhinoceros

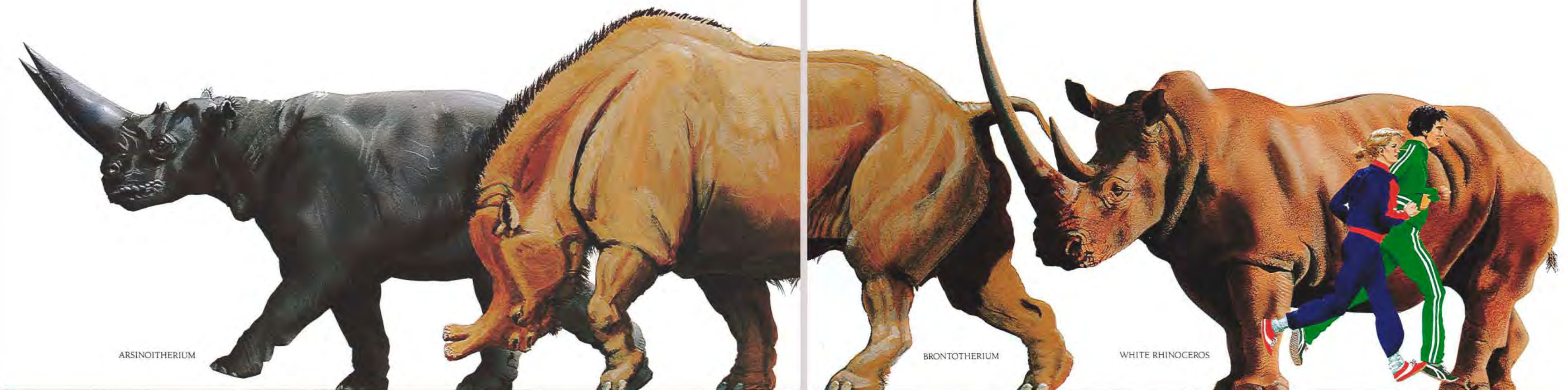
Ceratotherium simus
Perissodactyla • Mammalia • Chordata

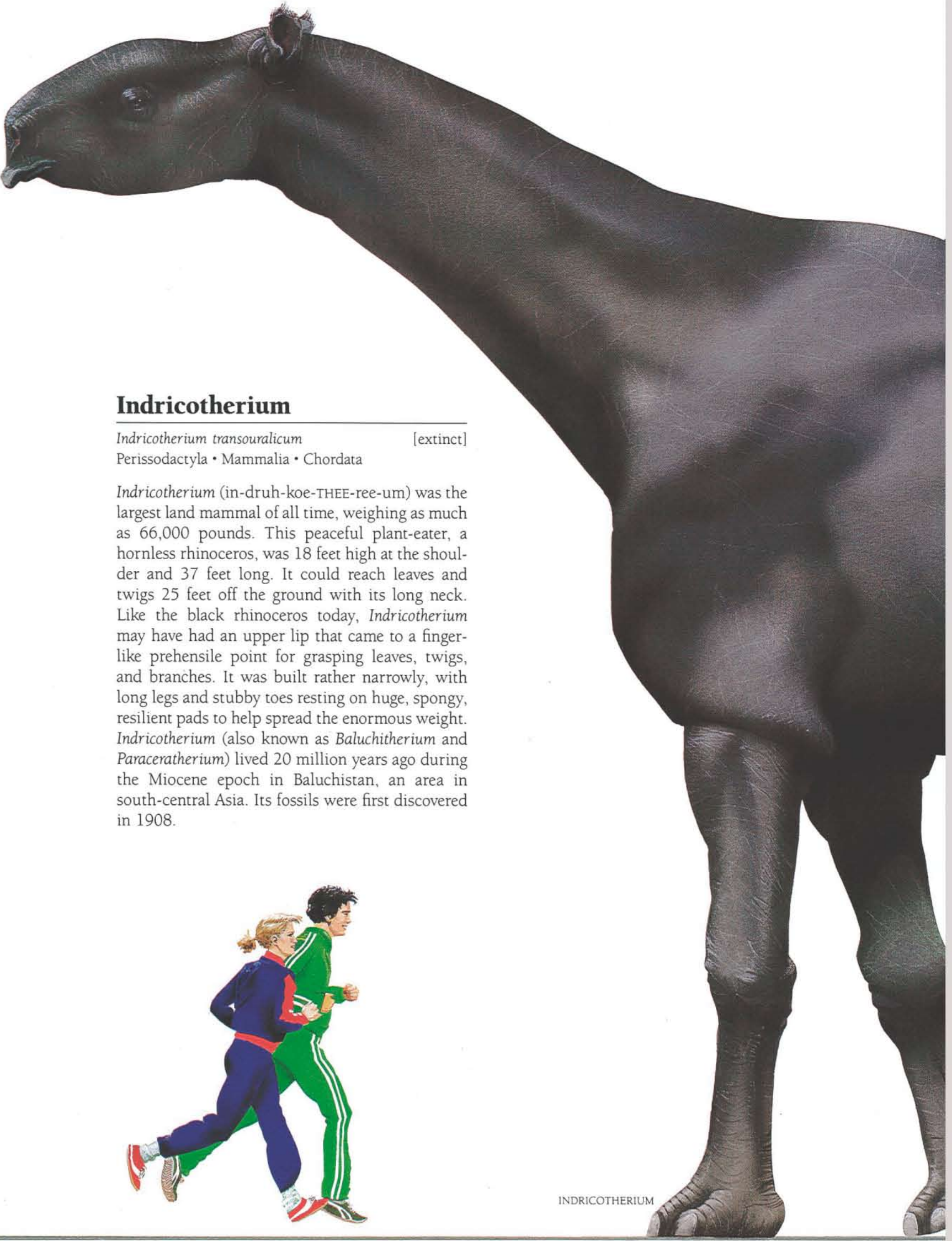
The white rhinoceros, also known as the square-lipped rhino, is the largest of the five species of rhinoceros alive today. Growing up to 15 feet long and 6½ feet high at the shoulder, the white rhino may weigh 7,000 pounds. The average white rhino is usually only 5½ feet at the shoulder. The two horns on its snout are as hard as bone but in fact consist of compressed, hairlike fibers that grow throughout the rhino's lifetime. The foremost horn can reach a length of 62 inches. Females have longer horns than males. With its wide mouth, the white rhino prefers to graze on grasses; the name "white" is a mispronunciation of the word "wide." The related black rhino is actually the same light gray color as the white rhino but has a pointed prehensile lip used to strip leaves off bushes.

The white rhinoceros inhabits dry country. Its

thick, hairless skin offers no protection from biting insects, so the rhinoceros frequently wallows in mud or takes dust baths for relief. The white rhinoceros is often solitary but may form small herds. Gestation is up to 17 months after which a single hornless calf is born. The calf stays with its mother for over 2 years and is sexually mature at age 5. A rhinoceros's life span is 70 years.

The white rhino is bad-tempered in the wild. Confronted with objects that appear threatening, it will charge, reaching speeds of 30 miles per hour. There are only about 2,000 white rhinoceroses left in central Africa. The animal has been hunted nearly to extinction due to excessive demand for its horn, which in some societies is deemed to have medicinal and decorative value.





Indricotherium

Indricotherium transouralicum [extinct]
Perissodactyla • Mammalia • Chordata

Indricotherium (in-druh-koe-THEE-ree-um) was the largest land mammal of all time, weighing as much as 66,000 pounds. This peaceful plant-eater, a hornless rhinoceros, was 18 feet high at the shoulder and 37 feet long. It could reach leaves and twigs 25 feet off the ground with its long neck. Like the black rhinoceros today, *Indricotherium* may have had an upper lip that came to a finger-like prehensile point for grasping leaves, twigs, and branches. It was built rather narrowly, with long legs and stubby toes resting on huge, spongy, resilient pads to help spread the enormous weight. *Indricotherium* (also known as *Baluchitherium* and *Paraceratherium*) lived 20 million years ago during the Miocene epoch in Baluchistan, an area in south-central Asia. Its fossils were first discovered in 1908.

Dinohyus

Dinohyus hollandi [extinct]
Artiodactyla • Mammalia • Chordata

Dinohyus (die-noe-HIE-uss) means "terrible hog." Larger than any other known pig, this aptly named animal was 7 feet tall at the shoulder and 11 feet long and must have weighed 2,000 pounds. It lived during the Miocene epoch about 25 million years ago and is believed to have been closely related to the modern hog.

Like modern hogs, *Dinohyus* had a flat, sensitive

snout and probably a keen sense of smell. Its knobby skull was 3 feet long, sporting huge, tusk-like canine teeth. Males had larger tusks, indicating that *Dinohyus* used them as weapons, as do modern hogs. The tusks were also used for digging: *Dinohyus* was a root eater. It had four toes on each foot, the middle two forming hooves and the outer two not touching the ground—the same as modern-day pigs. *Dinohyus* fossils are fairly common and are found throughout the northern hemisphere.



Giraffe

Giraffa camelopardalis
Artiodactyla • Mammalia • Chordata

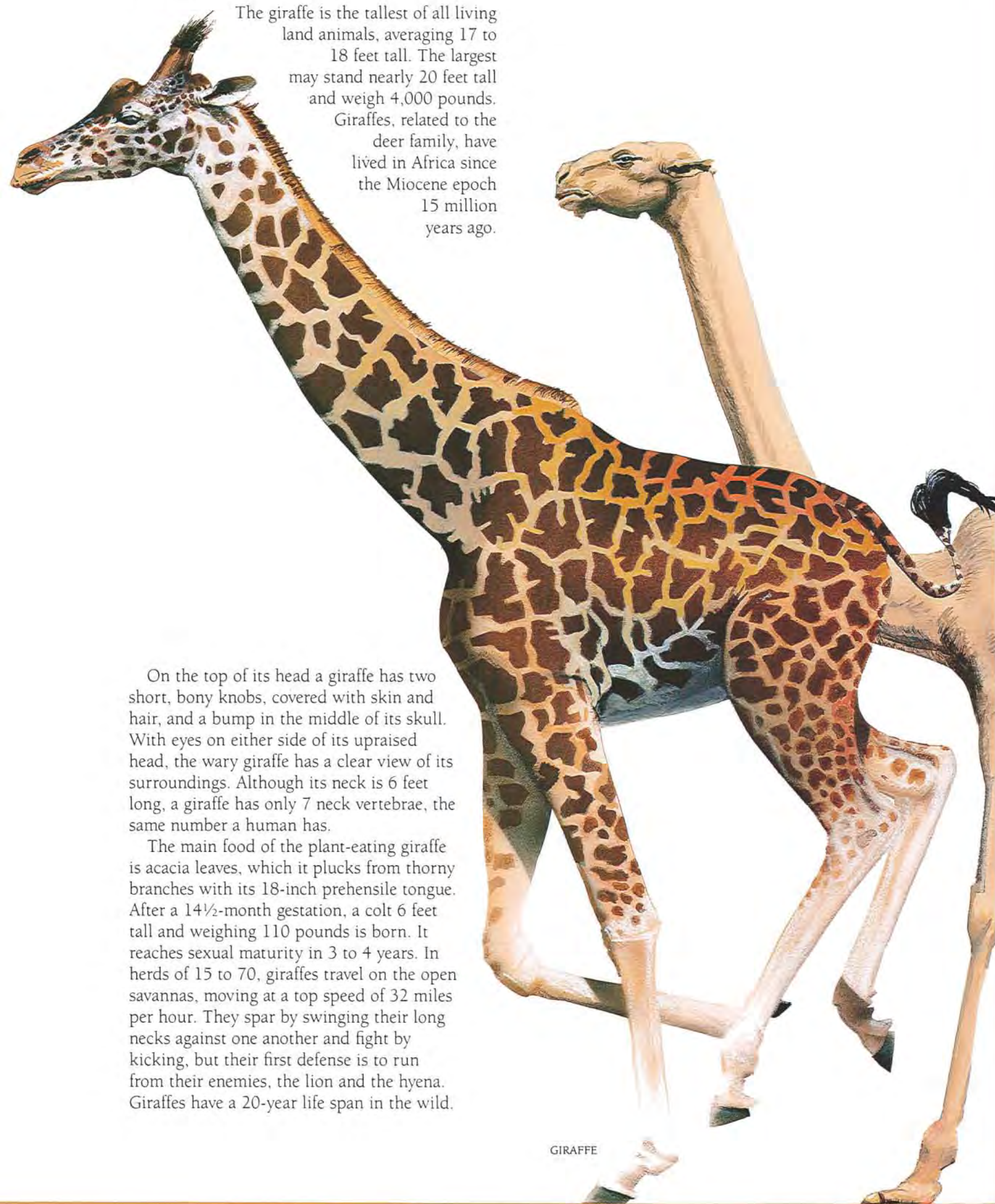
The giraffe is the tallest of all living land animals, averaging 17 to 18 feet tall. The largest may stand nearly 20 feet tall and weigh 4,000 pounds.

Giraffes, related to the deer family, have lived in Africa since the Miocene epoch 15 million years ago.

On the top of its head a giraffe has two short, bony knobs, covered with skin and hair, and a bump in the middle of its skull. With eyes on either side of its upraised head, the wary giraffe has a clear view of its surroundings. Although its neck is 6 feet long, a giraffe has only 7 neck vertebrae, the same number a human has.

The main food of the plant-eating giraffe is acacia leaves, which it plucks from thorny branches with its 18-inch prehensile tongue. After a 14½-month gestation, a colt 6 feet tall and weighing 110 pounds is born. It reaches sexual maturity in 3 to 4 years. In herds of 15 to 70, giraffes travel on the open savannas, moving at a top speed of 32 miles per hour. They spar by swinging their long necks against one another and fight by kicking, but their first defense is to run from their enemies, the lion and the hyena. Giraffes have a 20-year life span in the wild.

GIRAFFE



Alticamelus

Alticamelus altus [extinct]
Artiodactyla • Mammalia • Chordata

Alticamelus (al-tuh-KAM-uh-luss) means "high camel." Modern camels may reach 7 feet tall. At 18 feet tall, *Alticamelus* is the tallest camel yet discovered. *Alticamelus* lived 20 million years ago, during the Miocene epoch, in Asia and North America. It was a tree-browsing animal. Its stilt-like legs and long thin neck helped *Alticamelus* get at leaves no other animals could reach.

Alticamelus was the first species to show the camel's unique spreading feet. Most hooved mammals stand on the last joint of their toes. Camels stand on the last and next to last joints. Thick pads beneath the toes cushion each step and enable the animal to walk on loose sand. A camel's hump is made entirely of fat and acts as a reservoir to sustain the animal when food and water can't be found. *Alticamelus* may have had a hump of fat like a camel's, but we may never know. So far, only fossils of the animal's bones have been discovered.

Moose

Alces americana
Artiodactyla • Mammalia • Chordata

The moose, the largest deer ever, is found in North America. A bull moose can grow up to 7 feet 8 inches tall at the shoulder and may weigh up to 1,800 pounds. Cows are generally smaller and do not have antlers.

Each year the bull sheds his antlers and grows a new pair. The antlers, which can spread more than 6 feet across, are used when the bulls spar for mating privileges. The mating bellow of the bull moose can be heard for 3 miles or more. One or two calves, 32 inches tall at birth, are born after a 7½-month gestation period. The moose grazes on soft twigs, water lilies, mosses, and lichens in marshes near forests. It is a fine swimmer. The moose is generally a peaceful browser but is unpredictable and can be dangerous. Its enemies are bears, cougars, and humans.

ALTICAMELUS

MOOSE

