REPTILES AND DINOSAURS



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REPTILES AND DINOSAURS



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Contents

PHOTOGRAPH ON PAGE 1
The caiman, an inhabitant of South and Central America, is a reptile that lives mostly on crustaceans, insects, and invertebrates.



NAGA RASSA MASK

This mask is used during popular festivals in Sri Lanka to frighten evil spirits. In Asian cultures, nagas represent sacred serpents.

Feared and Worshipped

ecause of their frightening appearances, snakes, dragons, and crocodiles are found in the legends and myths of peoples throughout the world. In sculptures, paintings, and masks used for various ceremonies, many of these animals

are represented as good or bad gods or are associated with magical powers. The snake is usually linked to the primordial waters from which life was created. In Asia, it is said that nagas (sacred serpents) are descended from Kasvapa, the father of all life. Consequently, it is common during popular festivals for both men and women to dance disguised with masks that represent these animals in order to frighten away evil spirits and seek protection. Certain Papuan peoples believe that crocodiles have special powers, and in Europe, mythical winged dragons that breathe fire are viewed as the quardians of treasures. Throughout history, these animals have been both feared and respected, objects of fascination and passion. The purpose of this book

is to reveal, in detail, what reptiles are really like. Here you will find clear, precise information about the appearance and behavior of reptiles, including dinosaurs—a group of reptiles that dominated the globe for millions of years. This fascinating book, which features specially prepared illustrations and images, will reveal details about these creatures as if they were alive on these pages.

id you know that reptiles were the first vertebrates to become totally independent of aquatic environments? This was made possible by the emergence of the amniotic egg. Its shell and membranes enabled reptilian young to develop on land without the need to return to water. Today there are about 8,200 classified species of reptiles in a wide variety of shapes and sizes. These species include turtles, lizards, snakes, crocodiles, and tuataras. Clues about the lives of many of these animals can be found by examining their feet. Different species use their feet to scale walls, climb slender stalks, or run across loose, hot sand dunes. Some reptiles live underground, while others prefer the surface. Since their body temperature is variable, reptiles tend to spend many hours in the sun exposed to direct solar rays and infrared radiation released from heated surfaces.

ith their long, narrow bodies, snakes are different from all other reptiles because they have long spines with many vertebrae. Although they cannot hear in the way mammals do, they can detect low-frequency vibrations in the soil that reveal the presence of predators or prey. Most snakes are carnivorous and can eat objects larger

than their own bodies. Stealthy, undulating crawling, sudden color changes, and oversized jaws are other identifying characteristics of reptiles—amazing animals with extraordinary traits that have enabled them to survive for millions of years.

ach page of this book will help you to become familiar with these creatures that are so different from humans. Some of them give birth to completely developed young. They are not born fragile and immature, dependent on their parents to feed and take care of them, as most mammals are. Reptile species also vary widely in the types of scales they have. Their scales may have defensive knobs and spines, as is the case with the tails of some lizards, or they may form crests along their necks, backs, or tails.

Ithough snakes are some of the most commonly feared animals, only one out of ten is dangerous. Few people know that snakes are timid creatures that prefer to stay hidden. Most snakes will never attack unless they feel threatened and use warning mechanisms and behaviors before attacking. Unfortunately, others are poisonous—so most snakes are hated and persecuted. The process of learning more about them and learning to identify the really dangerous ones may help us to keep them from disappearing. Many reptile species today are in danger of extinction because of indiscriminate hunting and habitat destruction. Not only ecologists but all people must be concerned about their welfare, helping to ensure that they continue to be part of life on Earth.



uring the 170 million years from the late Triassic Period to the late Cretaceous Period, an extraordinary group of animals, called the dinosaurs, dominated the Earth. Some were small, but others were gigantic. Some ate only plants and had long necks, and others had sharp teeth. Currently we are increasingly wellinformed about dinosaurs because of the findings of paleontologists, who study the fossilized teeth and bones of these animals. Sometime during the late Cretaceous Period, dinosaurs disappeared from the face of the planet in an event known as the

K-T extinction event. Some attribute the dinosaurs' disappearance to the impact of a large meteorite with the Earth. In this chapter, you will find very detailed illustrations of these prehistoric creatures.

Terrible Lizards

inosaurs dominated the Earth for 170 million years, from the late Triassic to the late Cretaceous periods, when the supercontinents of Laurasia and Gondwana were splitting into the landmasses of today. The mass extinction of the dinosaurs about 65 million years ago left fossil remains, including footprints, eggs, and bones. Finding these fossils has enabled scientists to study and classify dinosaurs and to learn about their posture, size, diet, and many other aspects of their lives. These studies revealed that this prehistoric group of lizards included herbivores and carnivores of extraordinary size and striking shapes.

Legs

Depending on their lifestyle, some dinosaurs walked on two legs, and some walked on four. However, they all had a similar

LIZARDS

angles. This

The limbs project

elbows and knees, the

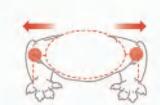
legs are bent at right

arrangement is called

extended posture.

outward. At the

posture. Due to the structure of their legs, they bear little resemblance to their relatives today: lizards, tuataras, turtles, snakes, and crocodiles.



IDENTITY

Terrible

DEINOS SAURO

The term Dinosauria was proposed for these extinct reptiles by paleontologist Richard Owen in 1842. The name of each species is based on characteristics of its shape and physiology, the name of its discoverer, or the location where it



CROCODILES

These animals have semi-extended posture. The limbs project out and down. The elbows and knees are bent at a 45° angle. These species crawl slowly and straighten up to run.





DINOSAURS

These animals had erect posture. The limbs project below the body. Both the elhows and the knees are beneath the body.



Marsh vs. Cope

The American paleontologists Othniel C. Marsh and Edward D. Cope faced off in a very peculiar struggle. They competed to determine who could find more dinosaur bones and species. The competition was plagued with corruption, mutual

accusations of espionage, fraud, theft, and even personal violence. Marsh considered himself the winner of "Bone Wars," but the field of paleontology was the real winner as roughly 130 species were identified between the two rivals.



SIR DINOSAUR

Sir Richard Owen, a British paleontologist, was the first to identify fossil remains of "terrible lizards," or "monstrous lizards." He proposed the term Dinosauria, based on his studies and discoveries, and made the first reconstruction of a fossil for the great London Exhibition of 1851.

Saurischians

These dinosaurs had hip bones similar to those of today's reptiles, such as crocodiles and lizards. Many species of saurischian dinosaurs have been found, including Velociraptor and Argentinosaurus. They had long, flexible necks and large claws on the initial digits.

> **Lizard Hip** Pelvic structure of saurischian dinosaurs

FIERCE LIZARDS Carnivores of the Cretaceous Period. They grew up to 46 feet (14 m) long and weighed up to 7.7 tons (7 metric tons). Their teeth were like knives.

SUBORDER

INFRAORDER

_____ Ceratosauria Coelophysis bauri

Tetanurae Allosaurus fragilis

Prosauronoda Plateosaurus engelhardti

Sauropoda Argentinosaurus huinculensis

INFRAORDER

Scelidosauria

Trimucrodon

cuneatus

Ornithischians

Herbivores with hip bones structured like those of birds. The pubis slants backward, parallel to the ischium. Some of the most famous ornithischians were Triceratops and Parasaurolophus, Some ornithischians were protected from head to tail by bony plates.

> They Only Look Alike In spite of their name, these animals are not ancestors of today's birds.

ORNITHISCHIANS Named for the curvature in their thighbones. They could walk on



SUBORDER

Stegosauria Stegosaurus

Ankylosauria Centrosaurus sp

Marginocephalia Triceratops

Euornithopoda Pisanosaurus mertii

GOLDEN YEARS From the primitive dinosaurs of the Triassic

Period, evolutionary lines of carnivores and herbivores diverged. Later in the Jurassic and Cretaceous periods large herbivores and fierce

carnivores dominated the landscape, living under environmental conditions that favored enormous diversity in body forms and feeding behaviorsuntil their extinction

ESTIMATED WEIGHT OF AN

ARGENTINOSAURUS

Over 2,000

SPECIES OF DINOSAURS HAVE BEEN **CATALOGED AT PRESENT.**



TRIASSIC PERIOD 251-199.6 MILLION YEARS AGO

JURASSIC PERIOD 199.6-145.5 MILLION YEARS AGO

Flexible Neck

Moved more easily because the

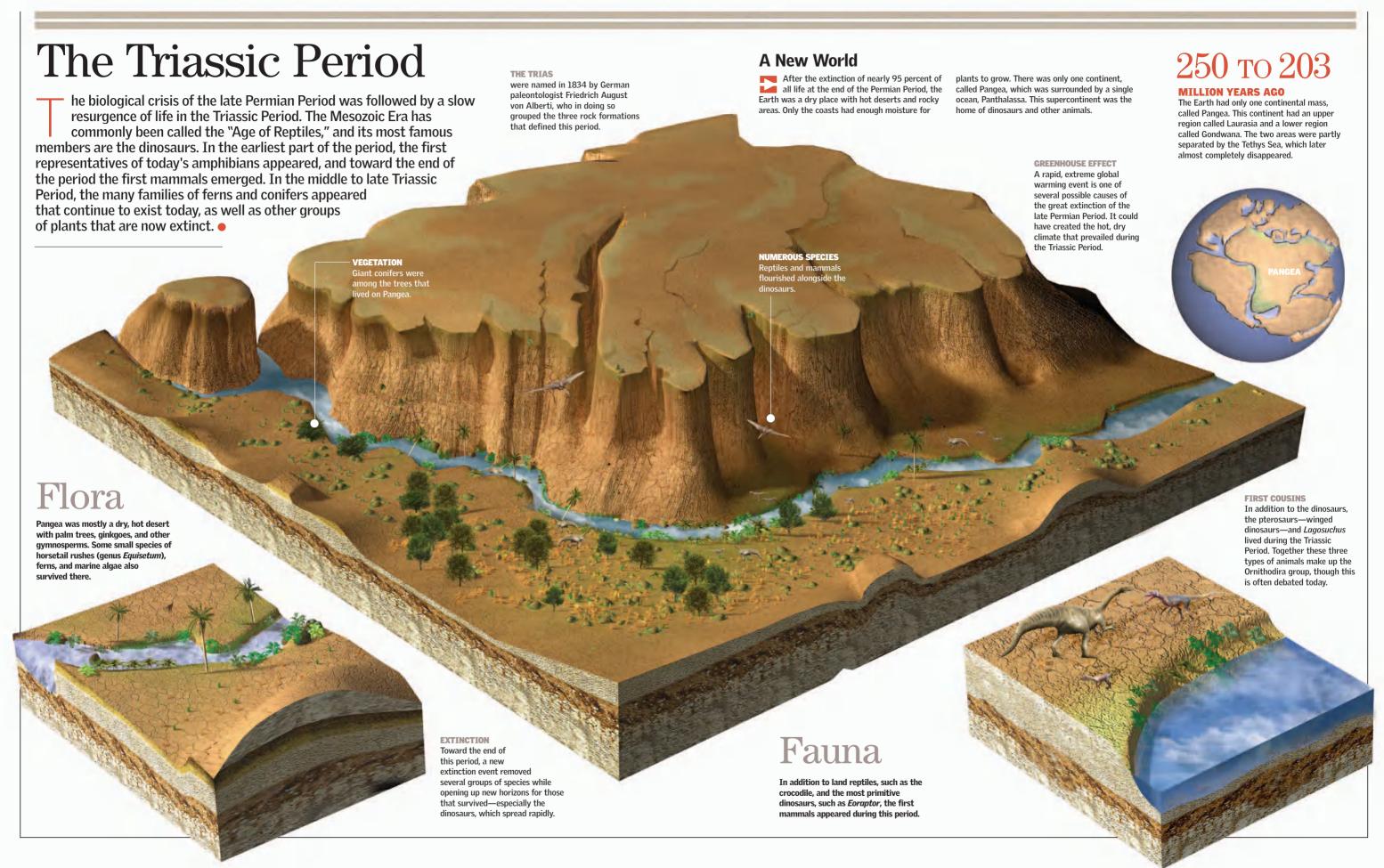
light in weight

BAROSAURUS

or "heavy reptile"

CRETACEOUS PERIOD 145.5-65.5 MILLION YEARS AGO

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The "Age of Reptiles"

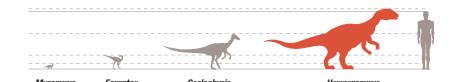
he first period of the Mesozoic Era gave rise to the "Age of Reptiles." On land, the synapsids, which later developed into mammals, began to decline, and the archosaurs, or "dominant reptiles," lived in various habitats. The earliest crocodiles began to develop, along with turtles and frogs, among others. The pterosaurs ruled the air and the ichthyosaurs the water. The dinosaurs—another order of archosaurs—appeared in the Middle Triassic, approximately 250 million years ago. Toward the end of the Triassic Period, many other reptiles declined dramatically, and the dinosaurs began their reign.

HERRERASAURUS

Herrerasaurus ischiaualastensis

Size	13 feet (4 m)
Diet	Carnivorous
Habitat	Conifer Forests
Epoch	Late Triassic
Range	South America

DIFFERENT SIZES



Herrerasaurus

is one of the most ancient dinosaurs. It is considered a key to understanding the path dinosaurs took to dominate the following 160 million years. The first fossils were found in the early 1960s in the Ischiqualasto valley in northern Argentina by an official paleontological commission headed by Osvaldo Reig. He named the dinosaur in honor of the local guide who found it. Since then several complete skeletons have been found.

A TRUE CARNIVORE

One of the traits that defined this animal as a dinosaur was its typical theropodian head. Its narrow skull had nasal cavities in the front part of its snout, and its eve sockets were part of a hollow bony structure, making its skull both lightweight and strong.

Its tubelike teeth were more curved than those of other carnivores that followed but they were sharp and serrated like those of its theropod relatives.

LIMBS FOR HUNTING

Like its head, this dinosaur's limbs had the same proportions as the later giant predators of the Cretaceous Period. Its small front limbs were designed for

The relative size of its front limbs suggests that this animal mainly walked on two feet. Each hand had three long claws and two short ones. Its hands were able to grasp with the help of "thumbs" slightly opposed to the other claws. Its hand was a formidable weapon for attacking and holding prey, an earlier form of the hands of other theropods.

On its lower limbs, this dinosaur's toe bones show a high degree of superposition. The toe bones of the first digit, although well developed, are very short and

lightweight compared to the second, third, and fourth toes. These long, strong feet enabled Herrerasaurus to run while bearing the great weight of its body.

The First Dinosaurs

The most primitive dinosaurs were very small in comparison to their relatives of later epochs. Most of them have been found in South America. They were carnivores. Some were scavengers, and others were highly agile hunters. They shared very primitive morphological structures with other reptiles of their group, the archosaurs. Mixed with these primitive structures. however, were advanced bone forms similar to those of the predators that would dominate the Cretaceous Period. These predators were known as the theropods. Throughout the Triassic Period, the early dinosaurs were an uncommon subgroup of reptiles. Toward the end of the Triassic Period, the first large herbivores appeared.

Eoraptor

Eoraptor fossils were discovered in 1991 in northwestern Argentina. This small carnivore lived 228 million years ago and measured up to 40 inches (1 m) long. It had sharp teeth and agile hind legs for running and chasing its prey. It may also have eaten carrion.

Tiny predator whose name ns "thief of dawn'

HOLLOW SHAPE

Most predators used their tails to keep their balance while chasing their prey.

SPINAL COLUMN

The central vertebrae are high and short, and the neural arches have square-shaped projections that are thicker toward the back. There are only two sacral vertebrae.

Mussaurus

The only known fossils of this species were found alongside eggshells. They were no more than 8 inches (20 cm) long. Their adult size is unknown, but it is estimated to have been as much as 6.5 to 8 feet (2-2.5 m). They are known to have been herbivores.

Coelophysis

This skilled carnivore could grow up to 9.2 feet (2.8 m) long. Two types of fossils have been found. They are believed to be males and females, respectively. Fossils of this biped hunter have been found in the United States in several southwestern states.

MUSSAURUS

pounds

PELVIS

had unique

spinal column.

Herrerasaurus was a verv

early saurischian with a

primitive sacrum, ilium,

and hind legs but a highly

developed pubic bone and

vertebrae. These traits show that this dinosaur

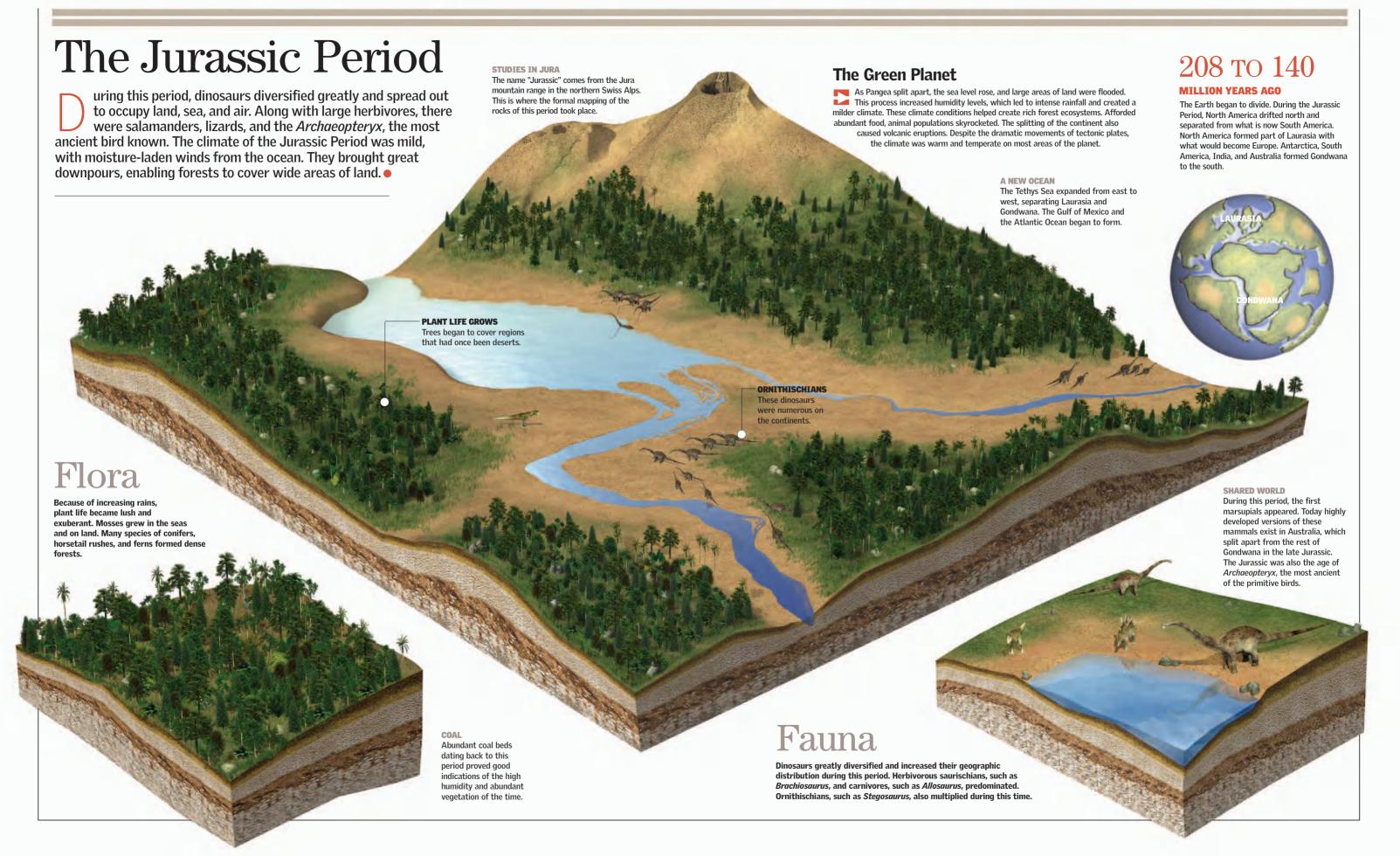
characteristics in its

An adult Herrerasaurus weighed between 220 and 880 pounds (100-400 kg).



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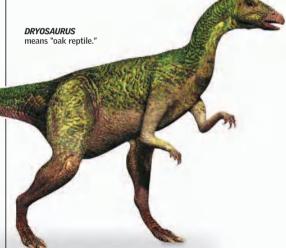
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Different Species

uring the middle of the Jurassic Period, the planet was lush and green. The gradual splitting of Pangea created new ecological environments, which were more humid and more diverse. The increased humidity enabled the growth of large trees and dense vegetation. This flourishing environment powered the continued diversification of different dinosaur species. In contrast, these conditions forced a decline in the majority of synapsids, and the archosaurs —the group that includes crocodiles—largely disappeared. Other species also found their ecological niches and multiplied. These species included sea creatures, such as sharks and rays, that resemble their modern relatives, as well as ray-finned fish with sharp teeth, such as the fierce predator *Aspidorhynchus*.

Giants of the Mesozoic

Giant herbivores dominated the Earth. However, increasing diversity also brought increasing competition. The large sauropods, such as *Diplodocus*, and ornithischians, such as the stegosaurids, had to watch out for larger theropods, such as *Megalosaurus*, as well as for hordes of small, swift predators, such as *Compsognathus*. The first bird to descend from small dinosaurs appeared.



Megalosaurus

In 1676, the bones of one of the first dinosaurs were found in southern England, although they were not identified as such until 1819. This theropod predator was highly intelligent in comparison to its peers. It lived 181 million years ago, grew up to 29.5 feet (9 m) long, and weighed 1.1 tons (1 metric ton). It walked on its two hind legs and had two powerful front claws.

Dryosaurus

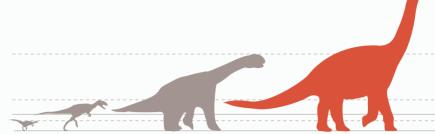
The fossils of this ornithopod, of the suborder Ornithischia, were found in Tanzania and the United States at the same time during the 19th century, in the middle of the so-called "Bone Wars." This lightweight herbivore could reach up to 14.8 feet (4.5 m) long and weigh nearly 200 pounds (90 kg).



Camarasaurus

This large, herbivorous sauropod lived on the plains of North America 159 million years ago. Its fossils were first found in 1877. It grew up to 65.5 feet (20 m) long; even so, it was easy prey for large predators such as Allosaurus. It could weigh up to 22 tons (20 metric tons), and it walked on four feet, which prevented it from running quickly enough to easily escape.

COMPARATIVE SCALE



Dryosaurus Meaalosaurus

C-----

Reachinsaurus

The length of its neck, in

sauropods of its time. By

means of its neck, which

could be up to 42.5 feet (13 m) long, it could reach the tops of

proportion to the rest of its

body, sets it apart from other

BRACHTOSAURUS

Brachiosaurus

Size	82 feet (25 m)
Diet	Herbivorous
Habitat	Tree-lined Savannas
Epoch	Late Jurassic
Range	North America

Brachiosaurus

For a long time, this sauropod was the largest dinosaur for which we had a complete skeleton. It was a four-footed herbivore with a small brain and a long neck. Specimens have been found in the United States, on the Iberian Peninsula, and in northern and southern Africa. The African species were from the Cretaceous Period and had slight anatomical differences.

Its tail was small in comparison to its body and was an extension of its spinal column.

LFGS

Its front

leas were

its hind

longer than

12

Height of Brachiosaurus,

because of its long front legs and long neck

Its eyes sat in large sockets.

Nasal Cavities

They are believed to have been resonance chambers.

Its head was small and had a crest between the

eyes. This crest had

large nasal cavities at the top. Its teeth were like pegs and had spaces

Jugal (Yoke) Bone was located behind the upper jaw and

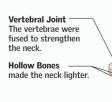
Teeth were used for tearing off tree branches when the head was pulled backward

Support This area anchored the

VERTEBRAE

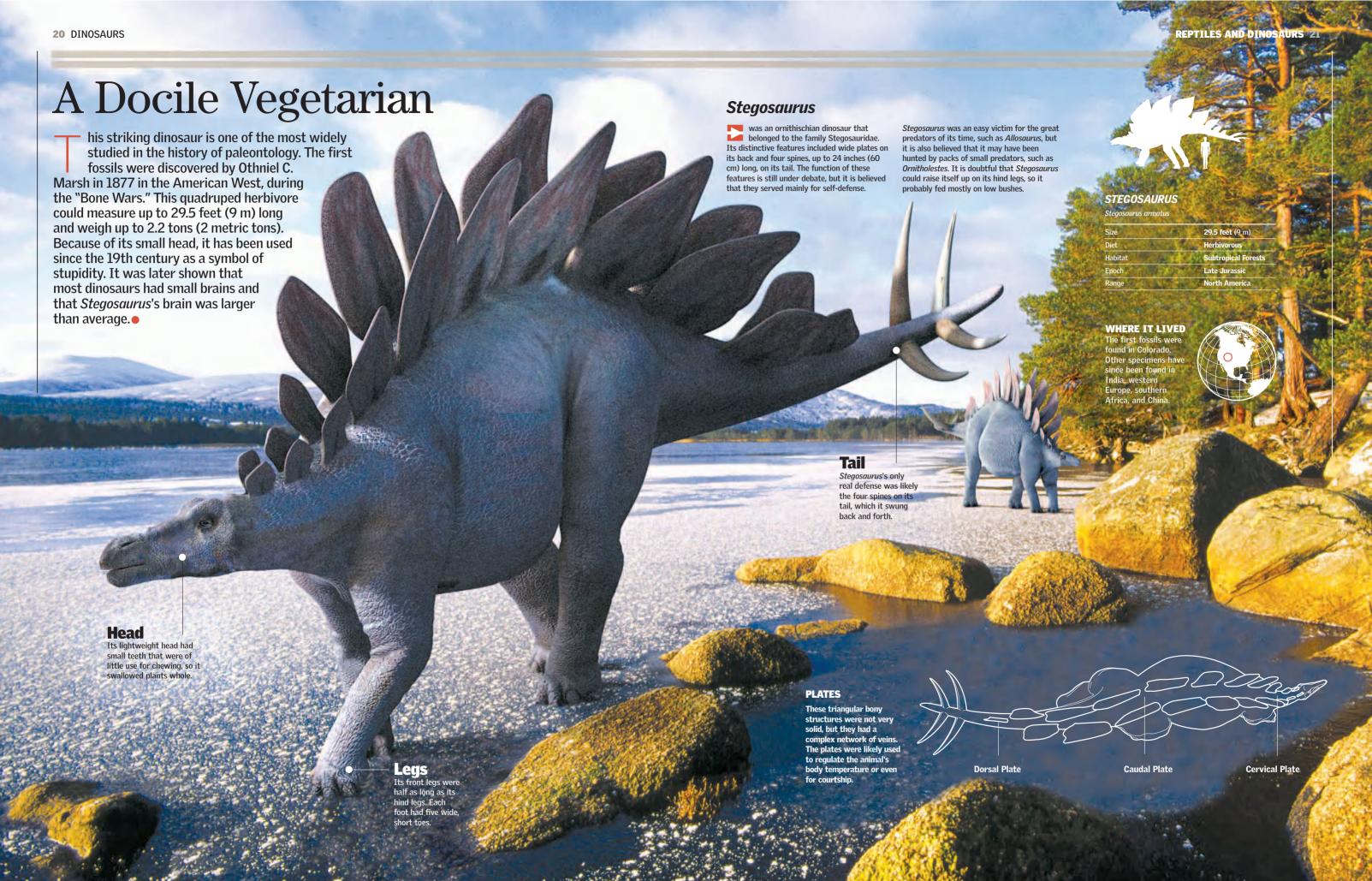
Brachiosaurus's extremely long neck had 13 vertebrae, with deep and complex cavities covered by membranes. It had 11 or 12

vertebrae in its back. Its short tail had about 50 bones, which helped it move easily.

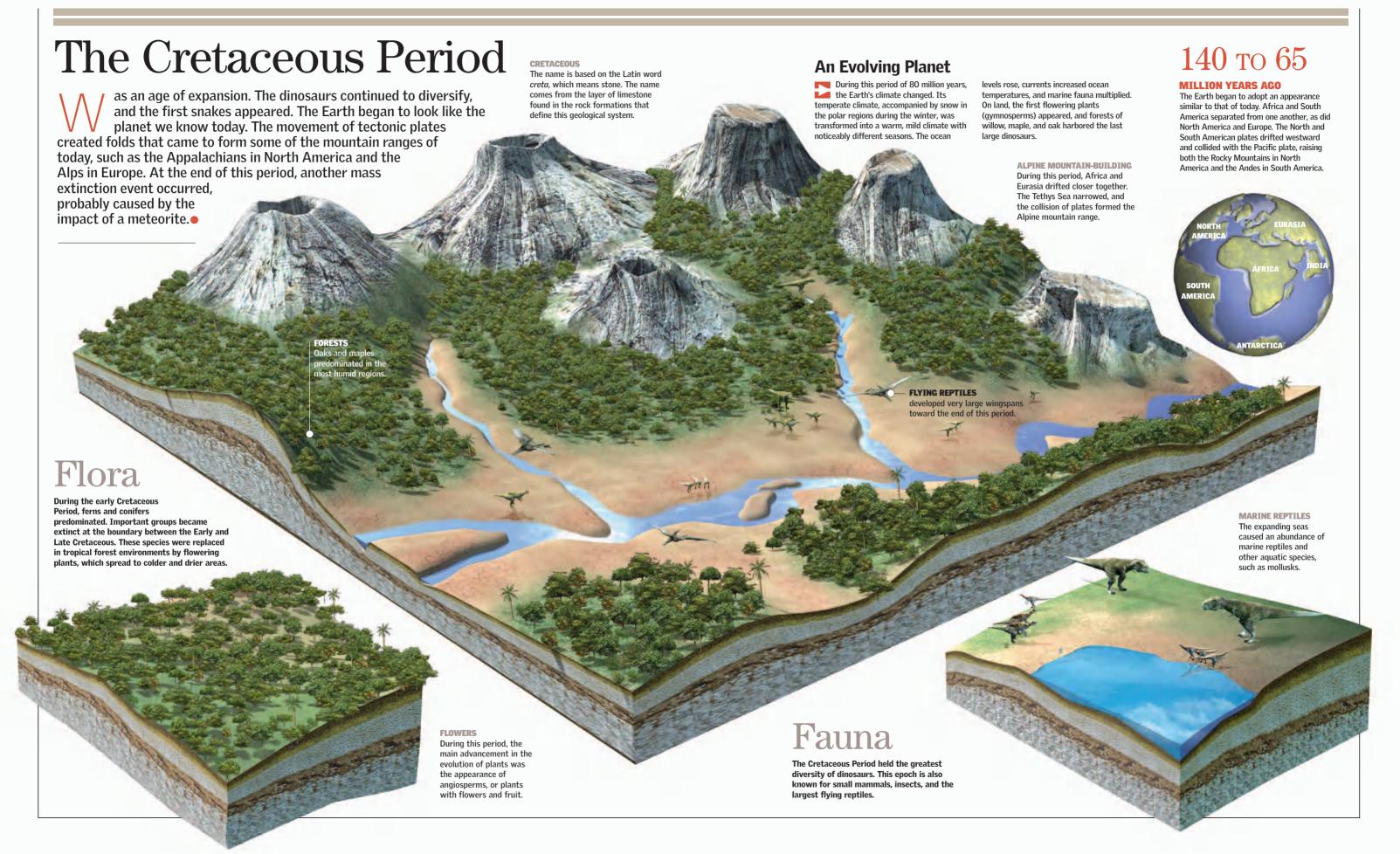


was made possible by a ball-and-socket joint.

------ 34.8 inches (88.5 cm)



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A Fierce Era

he Cretaceous Period saw both the splendor and the end of the "Age of Reptiles." It was the longest period of the Mesozoic Era, and for 80 million years, specific types of animal life developed in each region. South America was home to the largest herbivore known, Argentinosaurus huinculensis, which lived at the same time as the fearsome theropods. Some species of this period later survived the mass extinction—especially marine invertebrates, such as crustaceans, gastropod mollusks, and advanced ray-finned fish. Small mammals such as Zalambdalestes also survived.

The Struggle to Survive

Dinosaurs remained dominant during the Cretaceous Period. Although the large sauropods still existed, new groups emerged, intensifying the competition for resources. Enormous carnivores of the tyrannosaur family in North America and the

giganotosaurs in South America were the largest threats to the peaceful herbivores. New, distinctive species, such as the duck-billed hadrosaurs and the armored Triceratops, also appeared.



Caudiptervx

was a feathered dinosaur that lived in China in the early Cretaceous. It could grow up to 40 inches (1 m) in length and 27.5 inches (70 cm) in height. It was an advanced theropod. but it looked like a large bird, because its arms were covered with feathers and it had an elaborate, fanlike tail. It had claws and a beak with sharp upper teeth. It could reach great speeds when fleeing large predators.

CAUDIPTERYX

Suchomimus

Similar to a crocodile, this dinosaur was a dangerous theropod that lived in northern Africa during the middle of the Cretaceous Period. It could measure up to 42.5 feet (13 m) long and 16.5 feet (5 m) tall. It had a long snout with almost 100 teeth.

Corythosaurus

CORYTHOSAURUS

was an ornithischian dinosaur of the hadrosaur family with a showy crest. It could reach up to 33 feet (10 m) long. It ate bushes and fruit in forests, and it lived in herds. The color of its crest may have been a distinctive feature if herds of different species intermingled. Its upper jaw had hundreds of small teeth that were replaced often.

Therizinosaurus

Some scientists believe that this mysterious dinosaur was herbivorous. However, it has been classified as a theropod that lived during the Late Cretaceous in the region of the Gobi Desert in Mongolia. It was first identified in 1954, and its name means "scythe lizard." It was between 26 and 39.5 feet (8-12 m) long and weighed about 5 tons (4.5 metric tons). It was believed to have possessed a lifestyle similar to modern gorillas or the extinct giant ground sloths.



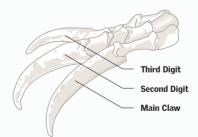
39.5 feet (12 m) Herbivorous (?) Habitat Subtropical Forests Late Cretaceous Epoch Range Central Asia

AN ENIGMATIC DINOSAUR

This dinosaur, one of the most perplexing of all, has been identified by fossils of its claws and a few other fragments that have been found. It is believed to share a common ancestor with the oviraptors. According to one theory, it was an easy prey for predators such as Tarbosaurus despite the size of its claws, which it probably did not use for defense.

The size of one of the claws on its front limbs

Its arms could measure up to 7.9 feet (2.4 m) long and were tipped with three digits that ended in powerful claws.



CLAWS

The head, atop a long

neck, was small, and

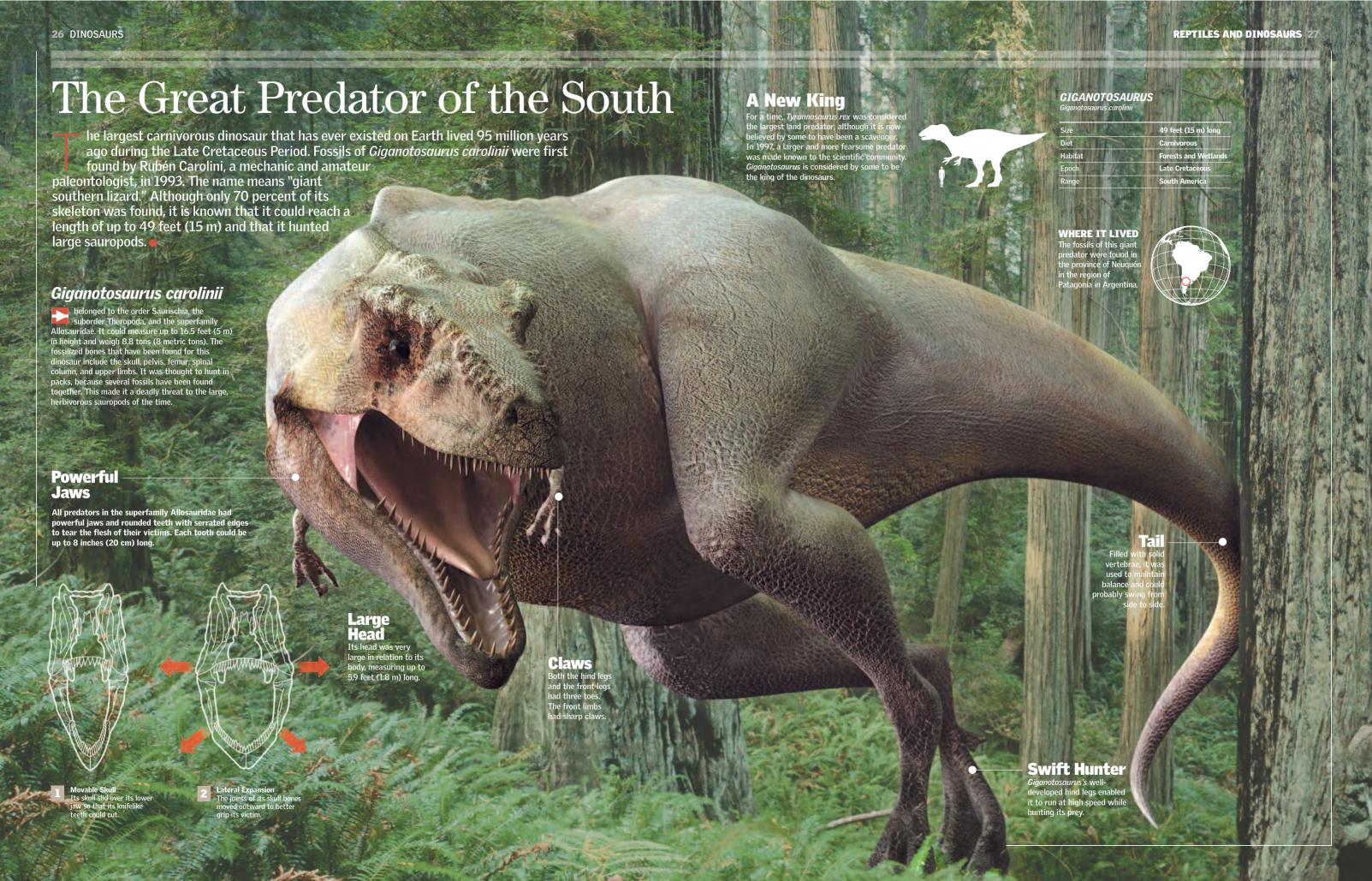
it had a beak-shaped

Its most notable characteristic was the large claws on its front limbs, each of which could measure up to 40 inches (1 m) long. The claw on its first digit was the longest of the three. It is believed that it used its claws to pull large branches to its mouth

COMPARISON OF SIZES



Its lower limbs had four small



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miles (10 km)

DIAMETER OF THE ASTEROID

that caused the Chicxulub

crater in Mexico

Living Life to the Limit

xtinctions of living beings on Earth have occurred in a series of drastic episodes throughout history, from the Cambrian Period to the Cretaceous. The most famous chapter is associated with the total disappearance of the dinosaurs about 65.5 million years ago. This mass extinction of these large reptiles is so important that it was used by scientists to indicate the end of the Cretaceous Period and the beginning of the Tertiary, a designation known as the K-T boundary ("K" is the abbreviation for Cretaceous). Natural phenomena of terrestrial or extraterrestrial origin are possible causes of the disappearance of these gigantic animals of the Mesozoic Era.

Other Proposed Theories

Not all scientists agree with the idea that a large meteorite caused the mass extinction of the dinosaurs. Rather, they suggest that the Chicxulub crater was formed 300,000 years before the end of the Cretaceous Period. These scientists claim that terrestrial events, such as volcanic eruptions, were more likely to have caused the Cretaceous extinction. According to intermediate positions, the eruptions may have been caused by a large meteorite impact.

During the Cretaceous Period, intense volcanic activity on Earth caused frequent, copious eruptions of lava and ash that exterminated the dinosaurs. Over 386 square miles (1,000 sq km) of volcanic rock deposited on the Deccan Plateau in India lend credence to this scientific hypothesis of the Cretaceous extinction.



...OR FROM THERE

As the Solar System crosses the galactic plane of the Milky Way, every 67 million years it changes the paths of meteoroids and comets in the Oort cloud. These bodies could enter the inner Solar System as meteors and possibly strike the Earth as meteorites.

Fatal Meteorites

In its long geological history, the Earth has witnessed several mass extinctions. Some scientists argue that the cause could be the same in all cases, and they point to extraterrestrial phenomena as the most likely cause. However, this hypothesis has been widely criticized. From the Paleozoic Era 570 million years ago to the Cretaceous Period, it has been determined that there were five or six mass extinctions on Earth, which mark the boundaries between the

following periods: Cambrian-Ordovician, Ordovician-Silurian. Devonian-Carboniferous, and Permian-Cretaceous. However, scientists have vet to determine a convincing factor that could be the cause in all cases. The Devonian extinction exterminated 50 percent of all species, much like the one occurring at the K-T boundary, However, the largest extinction of all occurred in the Permian Period, in which 95 percent of all species were

CLUES IN CHICXULUB

In the town of Chicxulub, on the Yucatán Peninsula in Mexico, a depression was found that measured 112 miles (180 km) across. This enormous imprint was evidence of the violent impact of an extremely large meteorite that crashed into the Earth.

MIXED ROCKS

Samples taken from the Chicyuluh crater show a miyture of terrestrial minerals (dark areas) and meteorite minerals (light areas).

became extinct at

LOCATION OF THE CRATE



like the one dropped on Hiroshima equal the force of the impact of one meteorite measuring 6

 $2 \, \mathrm{miles} \, (180 \, \mathrm{km})$

DIAMETER OF THE CHICXULUB CRATER on the Yucatán Peninsula



Reptiles: Background

GOOD VISION

Iguanas have very good vision. They see colors, and they have transparent eyelids that close easily.

A SKIN WITH SCALES 32-33
THE FAMILY TREE 34-35

A LIVING FOSSIL 36-37

INTERNAL ORGANS 38-39
A MENU AT GROUND LEVEL 40-41
REPRODUCTION 42-43



olor plays a very important role in the life of iguanas and lizards. It helps to differentiate males and females, and when it is time to attract a mate, the members of

the iguana family communicate by showing bright colors, tufts of feathers, and folds of skin. Another particularity that distinguishes iguanas is their covering of epidermal scales. In addition, like all reptiles, they are not capable of generating internal heat, so they depend on external factors to maintain their body temperature. For this reason, you will frequently see iguanas lying stretched out in the sun.

When it comes to their diet, most reptiles are carnivores, with the exception of some turtles, which are herbivores. Reptiles are also characterized by their total independence from aquatic environments.

are almost always small.

In diurnal animals, the pupil is rounded.

A Skin with Scales

BLACK CAIMAN

Melanosuchus nigei

eptiles are vertebrates, meaning that they are animals with a spinal column. Their skin is hard, dry, and flaky. Like birds, most reptiles are born from eggs deposited on land. The offspring hatch fully formed without passing through a larval stage. The first reptiles appeared during the height of the Carboniferous Period in the Paleozoic Era. During the Mesozoic Era, they evolved and flourished, which is why this period is also known as the age of reptiles. Only 5 of the 23 orders that existed then have living representatives today.

> extends forward from the internal angle of the eye and covers it.

Habitat

Reptiles have a great capacity to adapt, since they can occupy an incredible variety of environments. They live on every continent except Antarctica, and most countries have at least one species of terrestrial reptile. They can be found in the driest and hottest deserts, as well as the steamiest, most humid rainforests. They are especially common in the tropical and subtropical regions of Africa, Asia, Australia, and the Americas, where high temperatures and a great diversity of prey allow them to thrive.

Suuamata

ISLAND SKINK

Corucia zebrata

EMBRIONARY

MEMBRANES They develop two: a

AMERICAN ALLIGATOR

Alligator mississippiensis

protective amnion and a respiratory allantoid (or

fetal vascular) membrane

This order constitutes the largest group of living reptiles and includes more than 6,000 species of lizards and snakes. The majority of animals in this order have hodies that are covered with corneous scales. The squamata include three forms of reptiles that are somewhat different from each other: the amphisbaenians, the lizards, and the snakes. It also contains certain extinct forms of reptiles, including nythonomorpha, which had snakelike bodies and lizard-like feet.

BOA CONSTRICTOR Boa constrictor

ROSY BOA Charina triviraata

> THE TONGUE Large, protractile, and bifid, a reptile's tongue is very short and thick and it contains the

> > **RIVER TURTLE**

SNAKES EXIST

They regulate their temperature by taking advantage of different sources of external heat, such as direct sunlight and stones, tree trunks, and

patches of ground that have

APPROXIMATELY

The body temperature of reptiles depends on the environment—they cannot regulate it internally. This is why higher temperatures increase their vitality.

Dry, thick, and impermeable, it protects the body from dehydrating even in very hot, dry climates.

Chelonians

The order of the testudines differentiated itself from the rest of the reptile world during the Triassic Period. Today it comprises marine turtles and terrestrial turtles. The species of this order are unique. They are covered with shells that consist of a dorsal carapace and a ventral plastron. These shells are so much a part of these animals that their thoracic vertebrae and ribs are included in them. Since these rigid shells do not allow turtles to expand their chests to breathe, these animals use their abdominal and pectoral muscles like diaphragms

HERMANN'S TORTOISE Testudo hermanni

SPECIES OF Crocodiles are distinguished by their usually large size. From neck to tail, their backs are covered in Since the ribs are fused with the shell, turtles cannot move their ribs to rows of bony plates, which can give the impression of thorns or teeth. Crocodiles inhale. They use the muscles in the appeared toward the end of the Triassic upper part of their legs to produce a Period, and they are the closest living relatives to both dinosaurs and birds. Their hearts are divided into four chambers, their brains show a high degree of development and the musculature of their abdomens is **SKELETON** so developed that it resembles the is almost entirely gizzards of birds. The ossified (not larger species are ver cartilaginous). **OVIPAROUS** Most reptiles are oviparous (they lay eggs); snakes and lizards are ovoviviparous (they give birth to live offspring). CENTRAL AMERICAL

34 REPTILES: BACKGROUND

REPTILES AND DINOSAURS 35

ARMOR

Sharp points formed a

protective armor

against predators.

The Family Tree

he first reptiles descended from ancestral amphibians. They distinguished themselves from their ancestors through mutations that allowed them to free themselves from their dependence on water for reproduction. Among these adaptations, the amniotic egg stands out, but equally important were the development of sex organs that favored internal copulation, an impermeable skin, and the formation of a low volume of urine that eliminates uric acid instead of urea. These adaptations to its environment were necessary to the reptilian dominance of the greater part of the Mesozoic Era.

SAUROPTERYGIANS

Small and irregular, they allowed the

animal to cut buds

for food.

was a structure formed by bony

GIANT FLIPPERS were used to move

through the water.

ribs that developed from the

vertebrae of the spine.

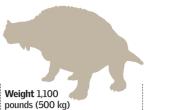
Tough Skin

was thin and

pronounced, with

small and sharp

Scutosaurs were quadrupeds with massive legs, similar to strong columns with wide bases, which sustained the weight of their bodies. These reptiles belonged to the extinct genus *Scutosaurus* species. They were large herbivores that lumbered through the pines and firs of Permian forests in search of food, such as herbs and soft buds.



SHIELD LIZARD

Scientific Name	Scutosaurus sp.
Diet	Herbivore
Habitat	Land
Location	Europe (Russia)
Fra	End of Permian

was short in relation to the animal's body size.

ORDERS OF REPTILES EXIST TODAY.

FLIPPERS
maintained the body's

Skull Types

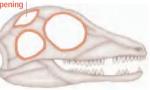
The fossils of the most primitive reptiles correspond with the Lower Carboniferous Period. These reptiles were terrestrial animals, somewhat similar to the Mesozoic reptiles. The diapsid lineage originated with them.



NAPSTD

A group of reptiles without openings in the skull near the temples. This is the condition seen in fish, amphibians, and earlier reptiles. Today's turtles belong to this lineage.

aniai onina —



DIAPSID

During the Permian Period, another group of reptiles emerged that had temporal openings in the skull behind each eye socket.

AIL

was very flexible, and it provided great agility for swimming.

ARCHEI ON

4,900 pounds (2,200 kg)

Scientific Name	Archelon ischyros
Diet	Omnivorous
Habitat	Marine
Location	North America
Era	Upper Cretaceous

15 feet (4.6 m)

were appropriate

for the animal's

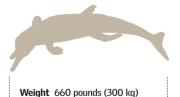
body weight. It

moved slowly

160 MILLION YEARS IS THE AGE OF THE MOST PRIMITIVE SEA CROCODILE FOSSIL.

Sea Crocodiles

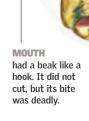
This genus of reptiles owes its name to its members' long snouts. The sea crocodile was a dangerous hunter, capable and opportunistic. It preyed on squid and pterosaurs, and it chased fish up to 20 feet (6 m) long—twice its own size. Its tail got thinner toward its end, which had a flipper. There was a small bump between its eyes. Sea crocodiles lived near the end of the Jurassic Period.



10 feet (3 m)

METRYORHYNCHUS

Scientific Name	Metriorhynchus sp.
Diet	Squid and Pterosaurs
Habitat	Marine
Location	South America (Chile) and Europe (France and England)
Era	Jurassic



IS WHAT THESE SEA TURTLES COULD HAVE WEIGHED

REPTILE

ANAPSIDS

Great Turtle

The Archelon ischyros was a giant marine reptile that measured 15 feet (4.6 m) in length. It inhabited North America during the Upper Cretaceous (between 75 and 65

million years ago). An omnivorous feeder

it passed slowly through shallow

waters by means of the propulsion provided by its flippers. The females laid eggs in holes just like the sea turtles of today.

EVOLUTION

CAPTORHINIDS AND HYLONOMUS

A Living Fossil

espite looking like lizards and sharing some common traits with last living sphenodont, and, because it has changed very little from its original form, it is called a living fossil. Two known species of tuatara have been identified, both of which inhabit the islands that lie off the coast of New Zealand. They live in burrows, and their great tolerance for cold allows them to survive at very low temperatures.

PINEAL EYE

can be distinguished in

younger specimens. In

adults, it is covered by the scales that grow

crocodiles, tuataras are a unique type of reptile. The tuatara is the Tuataras grow slowly and can live up to 80 years.



Tuataras can shed their tails to avoid being captured. The lost portion grows back, but it differs both in color and in design from the original tail.

have four toes apiece.

SCALES

small and

granular,

arranged in

on its back are

while the ones on its

transverse rows.

MAORI LANGUAGE

"Spiny back"

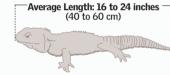
IS THE MEANING OF "TUATARA" IN THE



Sphenodon punctatus

Habitat Stephens Island Oviparous Reproduction Lifestyle

The males are much larger than the females.



is large compared to the body, and it lacks auditory structures.



behind each

eve (temporal

NUTRITION

Tuataras are carnivores. Their diet consists of are not separated insects, earthworms, snails, structures but rather a and crickets. Occasionally sharpened extension of they eat shearwater eggs the edges of both jaws. and nestlings.

EYE is large. The pupil is a vertical slit, and the iris is a dark brown color

> COLORATION Tuataras' tones vary from grayish to olive to brick red. Tuataras undergo significant variations in color throughout their lives

150 million years

SPINES

These smooth and

conspicuous spines are

more prominent in males.

THE LENGTH OF TIME TUATARAS HAVE EXISTED WITHOUT UNDERGOING EVOLUTIONARY CHANGES.

REPRODUCTION

Females are ready to mate once every four years. The male—the only modern living reptile without a penis—uses its cloaca to transfer its sperm directly into the female cloaca.

take a year to form inside the body of the mother and another year to incubate.

68° F (20°C)

There is an 80 percent chance hatch female.

percent chance that they will

There is an 80 that they will hatch male.

Behavior

Tuataras are nocturnal. During the day, they rest on rocks basking in the sun, and at night, they go out hunting near their burrows. Tuataras, unlike other reptiles, thrive in cold weather. Temperatures above 77° F (25° C) are lethal to tuataras, but they can survive temperatures as cool as 40° F (5° C) by hibernating. Tuataras are solitary, skittish animals.

BURROW

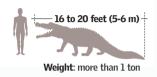
A tuatara can dig its own burrow or inhabit



REPTILES AND DINOSAURS 39 38 REPTILES: BACKGROUND

Internal Organs

he anatomy of reptiles enables them to live on land. Thanks to their dry, scaly skin and their excretion of uric acid instead of urea, they minimize water loss. The heart distributes blood in a double circuit. Crocodiles were the first vertebrates to have a four-chambered heart; the separation of the ventricles is incomplete in all other reptiles. The lungs, developed beyond those of amphibians, contribute to cardiac efficiency by allowing for greater exchange of gases.

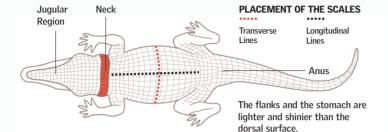


Crocodylus niloticus

Longevity

Carnivorous 45 years in the wild and 80 years in captivity

Reptiles have chromatophores that modify their color to a small degree. Two unique traits of crocodiles are that the skin on the head has glands that regulate the body's ionic balance, and the cloaca has glands that secrete substances crucial for mating and defense



A Question of Skin

The absence of extremities and the friction produced during movement give snakes the ability to slide and to shed their skin in one motion. Other reptiles must shed their skin by tearing it off in pieces. Reptiles shed their skin regularly and continue to do so even in the last

CORAL SNAKE

years of their lives.

Micrurus altirostris It is characterized by its smooth and brightly colored scales.

THE NUMBER OF TIMES A VIPER SHEDS ITS SKIN **OVER ITS LIFETIME. NEW SKIN** is smooth and bright. OLD SKIN is fragile. It rips easily.

Melanophores

Flexible Joint

GROWTH OF THE SCALES

Epidermis

The dermal layer is found below the epidermis.

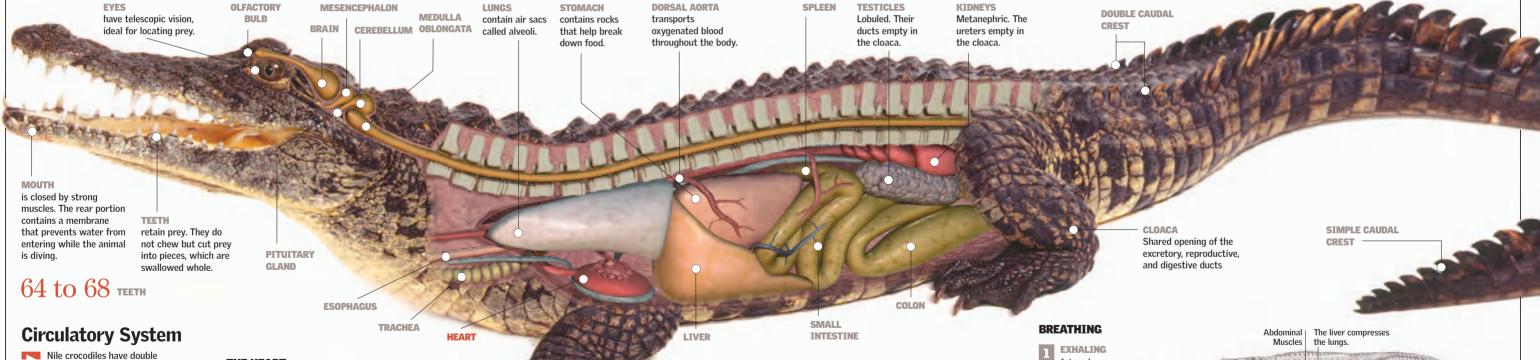
mm 2 Differentiation takes place

during dermal cell growth.

The epidermis secretes large amounts of keratin.

and a The new scales overlap each other and cover

the skin



circulation. A minor circuit brings deoxygenated blood to the lungs and transports oxygenated blood from them, and a major circuit transports the oxygenated blood to the rest of the body and returns deoxygenated blood to the heart. Reptile hearts have two auricles (atria) and a single ventricle, which is partially divided by an incomplete ventricle partition.

THE HEART

The flow patterns inside the heart prevent the mixing of pulmonary and systemic blood.

MAMMAL 4 Chambers 3 Chambers

AMPHIBIAN 3 Chambers



of reptiles.

BLOOD CIRCULATION An ample and efficient network of blood vessels extends throughout the bodies

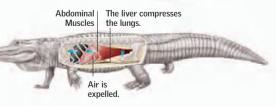
Respiratory System

is completely pulmonary. Most reptiles possess a pair of functional lungs, with the exception of snakes, which have only one functional lung. Body-wall muscles generate the pressure differences necessary to circulate air through the airways from the nasal cavities to the pulmonary alveoli.

Internal organs are compressed. This, in turn, compresses the lungs and causes them to expel air

INHALING

The pelvic bones rotate downward, the abdome stretches, and the muscles cause the lungs



The pressure difference causes the lungs to expand and take in air.



meat and plants. Reptiles and other species are part of a larger food chain—animals eat other animals, preserving the equilibrium of the environment.

CROCODILES

This diet is generally typical of other groups of animals; however, there are reptiles that feed only on green leaves and plants. The marine iguana eats only the algae that it finds under rocks on the sea floor.

Tauana iauana

GREEN IGUANA

Also called the common iguana, it is one of the few herbivorous reptiles. It feeds on green leaves as well as on some fruits.

SMALL LIZARDS LAND TURTLES

The Food Chain

Because they use photosynthesis, which permits inorganic carbon to be transformed into organic material, plants are the only true "producers" in the food chain. Herbivores feed on them and are thus first-level consumers. The

animals that feed on the herbivores are secondlevel consumers, and the animals that eat other carnivores—a category that includes some reptiles—form the third level of consumers in the

Metabolism

In the case of snakes that swallow their prey whole, digestion takes weeks and sometimes even months. Their gastric juices digest even the bones of their prey.

Turtles may be slow, but many include mollusks, worms, and slow-moving insect larvae among the items on their otherwise vegetarian menu. The loggerhead sea turtle, which measures over 6.5 feet (2 m) long, eats sponges, mollusks, crustaceans, fish, and algae.

WOOD TURTLE Clemmys insculpta

> **EYELASH VIPER** Bothriechis schlegel

Reproduction

ost reptiles are oviparous. Some species lay large numbers of eggs and then allow them to develop on their own, generally in well-protected nests or hidden under dirt or sand. Marine turtles, especially green turtles, travel to the coast to lay their eggs in the sand, where they are left at the mercy of all who pass by. The females of other species, however, fiercely protect their offspring, staying near their nests for long periods of time to scare away potential predators.

GREEN ANACONDA Funectes murinus An anaconda can have

The eggs remain in the mother's body. and hatching occurs there. The hatched more than 50 offspring. young are diminutive versions of adult which measure nearly animals. Already independent, they do 3 feet (1 m) long not receive any care from their parents. at birth.

> $\begin{array}{c} 145 \text{ to} \\ 160 \text{ days} \end{array}$ IS THE INCUBATION PERIOD OF THE LEOPARD TORTOISE.

Ovoviviparous

It can take the baby

animal an entire day to exit, and it will have a small sac hanging from its navel. This is the sac of yolk that provided it with food while it was incubating.



CARAPACE

already has mobility, thus allowing the baby

completely



reptile to walk.

LEOPARD **TORTOISE** Geochelone pardalis

Habitat	Africa
Diet	Herbivorous
Size	23-26 inches (60-65 cm)
Weight	77 pounds (35 kg)

FER-DE-LANCE

Bothrops atrox In one litter, it can produce up to 80 offspring, each with a length of 13 inches (34 cm).

Eggshells

Oviparous

Reptile offspring develop within a liquid-filled sac called the amnion, which lies inside the egg. Most reptile eggs have soft, flexible shells, but some have much harder shells. Through the shell, the hatchling absorbs the oxygen and moisture it needs for growth, while its yolk provides it with food.

Reproduction that involves laying eggs in

development before hatching. Some species

lay large numbers of eggs and then allow them to develop on their own, generally in well-protected nests or hidden in dirt or sand. In other species, such as crocodiles, the females fiercely protect their offspring.

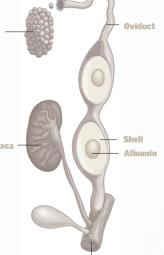
which the offspring complete their



has two ovaries that contain the ovules, leading into two oviducts that reach the cloaca. Fertilization occurs in the forward part of the oviduct.



The egg is buried by the mother, and the embryo begins to develop. The egg provides the necessary oxygen and food.



breaking the shell

during hatching

Fracture

The pressure exerted on the shell from the movements of the animal within such a cramped space causes the shell to break from the inside.



Hatching

The turtle is ready to come out and starts to break the egg with its body. Hatching occurs.



LEOPARD TORTOISE

SHELL allows oxygen to enter, so the embryo

Protected from drying out, it can survive without water.

YOLK SAC surrounds the embryo and stores food for its birth.

ALLANTOIS Prolongation of the embryonic intestines



The eggshell can be soft or hard. Soft eggshells are usually found in lizards and snakes, whereas hard eggshells are common in turtles and crocodiles.

CONSISTENCY OF THE EGGS





Viviparous

As is the case with most mammals, the whole embryonic developmental cycle occurs inside the mother's body, and the embryo obtains food from close contact with maternal tissues.





Lizards and **LIZARDS 46-47 CHANGING COLORS 54-55** This Australian lizard gets its name from the sharp spines that cover its body. It can consume **KOMODO DRAGON 48-49 VENERATED AND FEARED 56-57** Crocodiles **MARINE IGUANA 50-51** THE LARGEST ON THE NILE 58-59 up to 2,500 insects in one meal. GECKOS 52-53 THE AMERICAN EXAMPLE 60-61

ecause of their long, powerful bodies and sharp teeth, crocodiles are among the most dangerous predators. When they are small, they eat small

fish, frogs, and insects. When fully grown, however, they can devour large animals and even humans. We invite you to learn more about the life and habits of these animals. Did you know

that lizards are the most numerous reptiles in the world today? This group includes a wide variety of species of all shapes and sizes. They all belong to the taxonomic group Sauria, and most are carnivores. The Komodo dragon of Indonesia eats wild hogs, deer, and monkeys and can weigh nearly 300 pounds (135 kg). ●

48 LIZARDS AND CROCODILES **REPTILES AND DINOSAURS 49**

Komodo Dragon

his animal is the largest lizard in the world. It is related to monitor lizards and can grow up to 9.8 feet (3 m) long and weigh up to approximately 330 pounds (150 kg). These endangered lizards live only on a group of islands in Indonesia. They are carnivorous and are known for their ferocity in attacking their prey. Their saliva is full of bacteria that can kill their prey with only one bite. They can detect other Komodo dragons from several miles away.

INDONESIA Nusa



TOUGH SKIN

Number of Dragons Less than 5,000

How It Attacks Its Prey

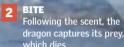
up to 11 miles (18



A Long Hunt

Komodo dragons have an acute sense of smell that can detect the presence of other animals up to 2 miles (3 km) away. They track their prey using their forked tongues to detect scents from molecules in the air. Jacobson's organ, located inside the mouth, helps the lizard to locate its prey more rapidly and consume less energy while tracking it.

They have an acute sense of smell that can detect the odor of ecomposing flesh at a distance of up to 3 miles (5 km).



favorite prey is deer and wild boars.

contains bacteria that are harmful to its prey. Antibacterial substances in the Komodo dragon's blood protect it from their harmful effects.

TONGUE

is forked and is used for tasting, smelling, and feeling. It can perceive

skin and bones of its prey.

STRUGGLE
Smelling a meal, more dragons approach. The largest get the best portions. The younger ones keep their distance, since the adults may act as cannibals.



Males can grow more than 10 feet



_ 3.3 feet (1 m) -

them to gu<mark>lp down up to</mark> 70 percent of their own weight in a single meal.



Deadly Saliva

bacteria that can quickly kill its prey by causing septicemia. To kill its prey, the Komodo dragon only needs to bite it once. An analysis of its saliva revealed 60 types of bacteria, 54 of which cause infection. These bacteria are known to cause putrefaction of

50 LIZARDS AND CROCODILES **REPTILES AND DINOSAURS 51**

Marine Iguana

he Galapagos Islands, besides serving as a home for many species of the Central Pacific and South America, also have an amazing number of indigenous species. One of these is the marine iguana, the only species of iguana in the world that spends most of its time in the water. This reptile lives on the rocky coasts and feeds on seaweed and algae. It can stay underwater for 45 minutes and dive approximately 50 feet (15 m) deep. This unique, slow-swimming creature gathers seaweed to eat at low tide or dives for food.

SCALY

Life in Colonies

The marine iguana is native to the Galapagos Islands and is the only lizard that finds its food in the sea. It lives in colonies, which is a curiosity given the solitary behavior of other iguanas. When they are not feeding, marine iguanas stretch out on rocks to warm in the sun. Thousands may be seen on one area of the beach. However, their peaceful coexistence disappears during mating season when males fight aggressively over females. The females reestablish harmony at nesting time. Since there is little space for the nests, thousands of females lay their eggs together. Each one can lay from one to six eggs. which are placed in a sandy burrow.

LEGS are kept to the side of

the body while







The Galapagos

the different ocean currents that

consist of 13 major islands, six small islands, and many islets, all of which are volcanic in origin. Located along the Equator, some 620 niles (1,000 km) west of the South American landmass, they are part of the territory of Ecuador. Their climate varies widely because of

around the archipelago. Because of their isolation, they are home to many indigenous species, most of which are birds and reptiles

Islands

WITHOUT ATR

a marine iguana can stay submerged while looking for food.

SPINES

SEAWEED

The different kinds of seaweed that grow on the islands may cause these reptiles to vary in

The crest is usually larger in males. When fighting for a female, they strike their crests against their opponents.

Swimming

English naturalist Charles Darwin described the marine iguana's style of swimming as "agile and rapid," but later studies and observations revealed the opposite. This animal, found only on the Galapagos Islands, swims very slowly and with very little energy. The fastest swimming speed recorded for a marine iguana was 2.8 feet (0.85 m) per second, and it only maintained this pace for two minutes. The average speed for a marine iguana is a mere 1.5 feet (0.45 m) per second, and only the largest iguanas are strong enough to swim above the waves.



Its legs are bent to the

Feeding Habits

The largest marine iguanas eat seaweed in the water, but the smaller and younger ones do not. Although adult iguanas can dive to a depth of about 50 feet (15 m), in normal conditions they feed at low tide in dives that last less than 10 minutes. Young iguanas, however, stay out of the water because their body temperature could fall rapidly. They can only feed on seaweed that grows on exposed rocks and is deposited at high tide.

Between its eyes and its nostrils, the marine iguana has glands to expel salt from its body. By exhaling strongly, it emits a jet of air that scatters the salt, which falls on its head and forms a white crest.

Geckos

eckos are a group of small, slender lizard species that live mostly in tropical and subtropical regions and on many islands in the oceans. Some species live in deserts, and many have burrows or make their homes in rock crevices. They are nocturnal and can flee from their predators by voluntarily shedding their tails. Geckos are the only lizards whose males produce sounds to attract females and to defend their territory. These agile climbers can walk on smooth vertical surfaces or even upside down by using tiny hairs on their feet that let them stick to anything they touch.

Leaf-Tailed Gecko

When hanging by its tail, it looks exactly like a leaf, which gave rise to its common name. Male geckos can produce sounds similar to vocalized calls. In this species, they are especially loud and high-pitched.



LEAF-TAILED GECKO

Scientific name	Uroplatus henkeli
Family	Gekkonidae
Habitat	Trees
Range	Madagascar, Africa
Diet	Carnivorous (insects)

Flight of the Gecko

The Kuhl's flying gecko lives in trees in Southeast Asia. Unlike flying lizards, it glides with its webbed feet. When it is not "flying," it spends most of its time hanging head down in the trees, ready

,050 **SPECIES ARE IN** THE GECKO FAMILY

> Its tail is autotomic. meaning that the gecko can shed it, allowing the reptile to double its speed.

> > are those of a great climber.

Its muscular legs

The texture of its skin helps it to blend into its

> Scientists have explained the gecko's capacity to cling (which even enables them to climb glass and never get it dirty) through electrostatic principles and even

Vhen walking, it up to 15 times per

The spatulae are very close to each other

generate the same molecules together.

2 million

THE NUMBER OF HAIRS

(SETAE) ON A GECKO'S

at a 30° angle attractive force.

Unlike most lizards, geckos do not have movable eyelids. Their eyes are covered with a transparent membrane that they shed periodically, along with the rest of

Using its long, sticky tongue, the gecko cleans the membrane over its eyes and keeps it free of dust.

Geckos cannot blink. They have only a fixed lens, with an iris that enlarges in darkness.

A gecko's feet end in toes surrounded by smooth membranes. They have 20 to 23 adhesive pads on the underside of the fourth toe. Geckos can climb directly upward and cling to smooth surfaces, because each toe has a disc with tightly packed concave areas that act as suckers.





Geckos have tiny filaments on the ends of their toes called setae.

Each seta ends in up to 1,000 microscopic hairs called spatulae.





Spreading Its LimbsThe membranes between

its toes are used as wings



hing Its Back The membranes along its sides and flat tail help it to regulate its fall.

Changing Colors

hameleons are well known for their ability to change color. Another interesting fact is that their tongue can stretch great distances in seconds. They live mostly in Africa. Their prehensile tails and toes make them excellent climbers. Another helpful characteristic is that their eyes can move independently of one another, providing them a 360° field of vision. Their flat bodies help them to balance and to hide among the leaves.



nge	Madagascar
bitat	Coastal Regions
estyle	Diurnal



Feeding Habits

These diurnal hunters wait for victims to pass by. Their diet includes arthropods and small invertebrates. Among insects, they prefer crickets, grubs, cockroaches, and moths. Other species on the menu also include songbirds and mice.





Protractible Tonque

Long and lightweight, the chameleon's tongue is sticky and can be extended. Chameleons throw their tongues outward like projectiles to hunt their prey.



Contraction

Several sheets of collagen between the tongue and the accelerating muscle are compressed in the form of a spiral, which stores the energy necessary to propel the



PREHENSILE TAIL

They use their long curved tails to hold on to branches without using their feet.

Unfolding

The accelerating collagen tissues, launching the tongue



Retraction

When the elastic tissues contract again. they roll up the tongue and return it to its initial position with the



Up to 600%

of the tongue's length is curled up in reserve.

How It Changes Color

changing ability of chameleons, well known in popular d songs, is not an adaptation to the environment as is leved. Rather it is related to changes in light and perature, courtship behaviors, or the presence of a predator.

It changes are caused by the action of hormones on pigment

in the skin. These specialized cells, located in each layer of the dermis, react and change color, camouflaging the chameleon from

detects a yellow color, the blue light of the guanophores (white chromatophores)

CELLS

PIGMENT

The melanophores contain a dark pigment called melanin, which regulates the brightness and the amount of light reflected, varying its

FEET The toes are divided into two parts, with two

toes on the outside and





The American Example

aimans also belong to the order of crocodilians. These fierce reptiles live exclusively in the tropical regions of the Americas, mainly in lakes and swampy regions. Occasionally, when looking for food, they enter areas populated by humans. The caiman family includes the genera *Caiman*, *Melanosuchus*, and *Paleosuchus*. The largest species is the black caiman, so named because of the color of its hide.

Black Predator

The black caiman is distinguished from other caimans by dark stripes on the lower part of its mouth and yellow lines along the sides of its body. However, it is similar to other caimans in its feeding habits, which depend on its age. Young caimans feed on arthropods and amphibians, while adults eat fish, birds, and mammals, or snails if other foods are scarce. Caimans do not have a large appetite. For example, in captivity they consume only 14 ounces (400 g) of meat twice a week.



BLACK CAIMAN Melanosuchus niaer

Habitat	Equatorial Amazon River
Lifestyle	Aquatic
Length	8-10 feet (2.4-3 m)
Life Span	30 years

Weight 880 pounds (400 kg)

99%

This species is in dang of extinction because poaching.

Reproduction

Caimans mate in the water. Once the eggs have been fertilized, the females begin to build their nest, forming a mound out of dry vegetation and earth. With their hind legs, they dig a hole in the center where they lay their eggs—from 30 to 75 at a time. When finished, they cover the nest with earth. In some cases, the females return to the water and have nothing more to do with the eggs.

NEST

The eggs that are exposed to the air, which are not kept as warm, will hatch as females.

BRANCHI AND DRY LEAVES UTURE EMALES

FUTURE MALES

MOTHER WITH YOUNG
Some females fiercely defend their offspring.

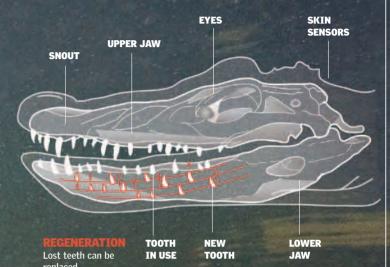
Large Mouthfuls

Caimans' teeth are not used for chewing or cutting but to trap, hold, and puncture the bodies of their prey. When a caiman's victim is large, such as a capybara or a wild boar, it twists its body in the water to tear off a chunk and swallow it. Caimans also hide their prey underwater to soften their body tissues. This makes it easier to rip off mouthfuls of flesh, which they swallow whole.

72 to 76 teeth

ARRANGEMENT OF TEETH

Caimans have five teeth in their upper front jaw, 13 to 14 in the rest of their upper jaw, and 18 to 19 in their lower jaw.



A Hard Life

EYES OUT OF THE WATER

NOSTRILS ABOVE THE In the state of Louisiana, a white alligator with no skin pigmentation lives in captivity. This trait would make it vulnerable in the wild, because it would be unable to absorb energy from the sun, a process that is crucial for many reasons, especially for the maintenance of its body temperature, allowing it to have enough energy to attack its prey.

SUBMERGED BODY

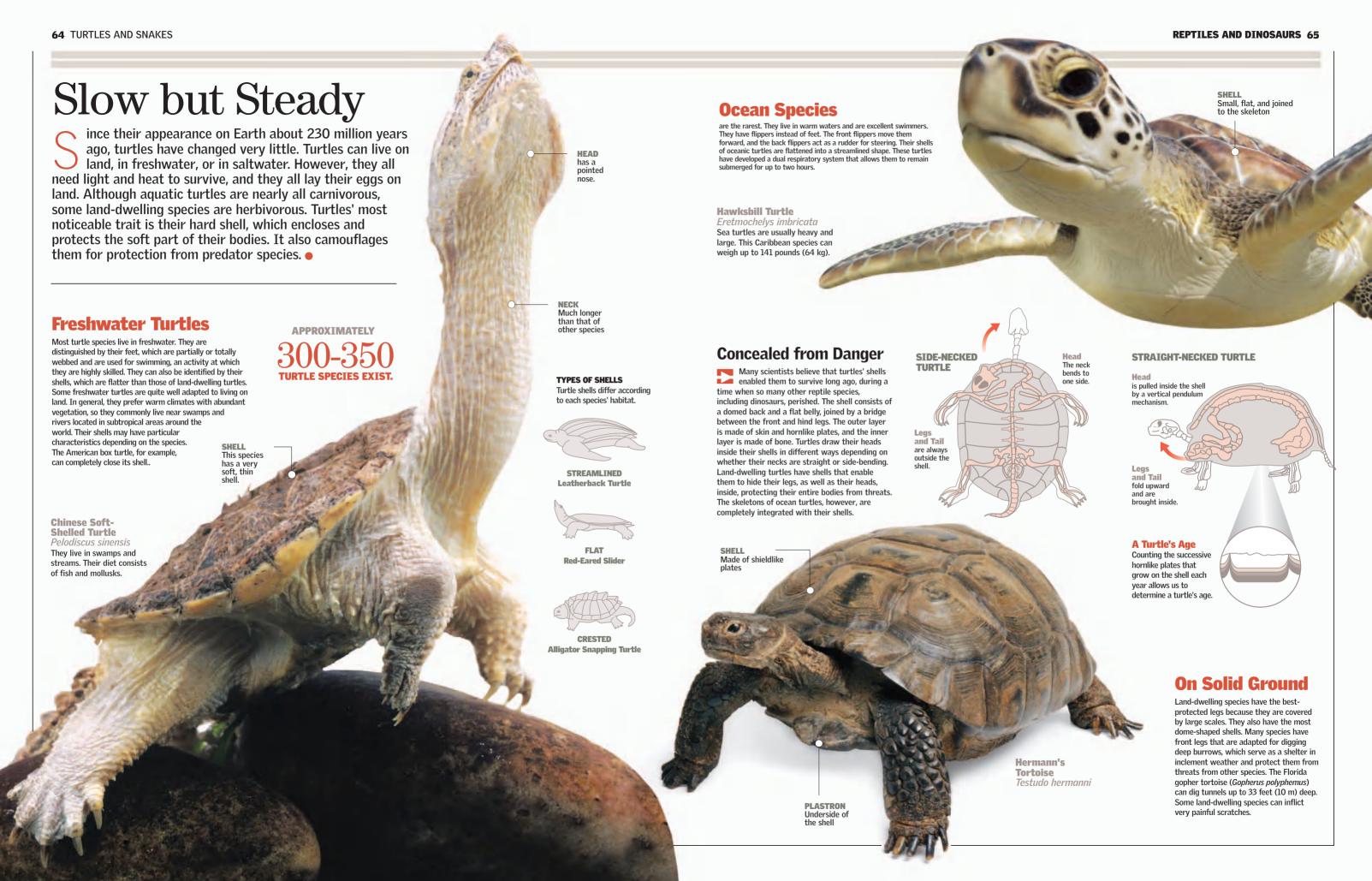
ADULT SPECIMEN

Adults spend most of the day in the water. At night they come on shore to hunt.



n this chapter, you will discover the amazing world of turtles and snakes. You will learn what they are like inside, where they live, and how they hunt their prey, as well as why some eat only eggs and others, such as constrictors (the most primitive snakes), have to suffocate their prey by coiling around it. This chapter will also reveal interesting facts about turtles' skeletons and shells (for example, turtles that swim have streamlined shells that enable them to glide easily through the water). Although people may think that turtles

are peaceful creatures, many are actually carnivorous hunters that eat small invertebrates, fish, and even some larger animals.



Mating

and fertilize her

is rather aggressive; the female in order to mount

weeks and makes from three to

Its shell is hard and spherical.

2.5 inches (6 cm)

Long-Lived Giants

iant tortoises once lived on all the continents except Australia and Antarctica, both before and during the Pleistocene Era. They are now extinct on the continents and are only found on the Aldabra atoll in the Seychelles islands in the Indian Ocean and on the Galapagos Islands off the coast of Ecuador. In the Galapagos there are distinct populations living in different parts of its small area. The Galapagos giant tortoise, Geochelone nigra, is the largest tortoise in the world, weighing up to 880 pounds (400 kg). The oldest one still living is over 175 years old.



Almost 1,000 eggs CAN BE LAID BY A FEMALE IN ONE SEASON. HOWEVER, VERY FEW YOUNG TORTOISES SURVIVE.

stretch its

RETRACTABLE NECK enables it to hide its head inside its shell.

can reach the

Giants

There are now 11 subspecies of Galapagos tortoises, including water-dwelling and land-dwelling varieties. All are in danger of extinction. They differ in maximum sizes, shell shapes, and neck



CLOSE RELATIVES

LIVE WITHOUT EATING OR DRINKING

PLATES

the case of

In addition to suffering from poaching humans in the past, Galapagos tortoises are in danger of extinction because of the low survival rate of their hatch are hunted by two types of species that have been introduced to their habitat: black rats and cats. Furthermore, the diet of adult female tortoises causes them to compete for food with goats and other livestock, more species not native to the tortoises' ecosystem.

ANIMALS INTRODUCED BY HUMANS









The Life Cycle

Up to four months can pass between the time a new turtle is conceived and the time it hatches. Laying eggs takes several hours of work, and a female can lose up to 20 percent of her weight during this process. The large size of Galapagos tortoises makes them lazy; they spend most of their time sunning themselves in small groups on warm, dry volcanic soils near the coast or a swamp. Some eat carrion.

Most Stable Size

After this point, its rate

Development

digs a funnel-shaped hole with her claws, softening the ground with her urine. She settles the eggs in

Nesting

For nearly five hours, the female layers, covers them with earth, and

SCALES

are typical of

FRONT LEGS

SHELL

weighs over 550 pounds (250 kg),

enough to crush

Turtles in the Water!

ea turtles have had to adapt parts of their bodies to an aquatic environment. Their front legs propel them through the water, and their hind legs serve as rudders for steering. Their shells are highly streamlined. They can spend up to several hours submerged in the water, since they have a dual respiratory system. They lay eggs but make their nests on solid ground, and they have an interesting system for choosing the spot where their young will be born—they return to the same spot where they, themselves, were born.





GREEN SEA TURTLE

Habitat	Tropical and Subtropical Waters
Diet	Herbivorous
Length	Up to 39 inches (100 cm)
Life Span	50 years (estimated)

MODIFIED FEET

have become relatively large flippers.

FLIPPERS

Extension of the bones that make up the main part of

BONY PLATES

are embedded in a thick, leathery, smooth skin, which gives the turtle the name leatherback. Its oily skin helps it to maintain its internal body temperature.

Sizes

Sea turtles' measurements vary widely by species. The largest living species is the leatherback, and the smallest is Kemp's ridley.



When winter arrives, sea turtles migrate in warm ocean currents. such as the Gulf Stream, to places with higher temperatures. However, they sometimes stay too long in these currents. which then vanish, leaving the turtles in frigid water.

Using their flippers to make powerful strokes, sea turtles move through the water in a manner

up to 9 feet (2.7 m) long and weigh up to 1,500 pounds (680 kg).

100 feet (30 m) Kemp's Ridley Turtle

Green Sea Turtle

3,300 feet

is relatively large and cannot be retracted into the shell.

EYE has a double pair of eyelids

LEATHERBACK

Reproduction

MIGRATION

FROM BIRTH ΔREΔ

The reproductive cycle of sea turtles repeats every year, every two years, or every three years. Nesting is done during the summer on sandy beaches in tropical and subtropical areas where the average water temperature at the surface is always above 75° F (24° C). Every one, two, or three years, the turtles return

from their feeding areas, which can be several their nesting sites. Apparently the turtles are able to memorize the exact location where they were born. They seem to navigate by ocean currents and temperatures.

TO BREEDING AREAS MATING

upper side and nearly at on the underside.

Breathing

Sea turtles have wedge-shaped lungs that lie underneath their shells and are attached to their backs along the spine. Sea turtles can also breathe

22 miles per hour (35 km/h)

THE SWIMMING SPEED OF

Swimming

To be able to swim, turtles needed to adapt their front limbs and transform them into large flippers. Their hind limbs took the form of oars. They have a membrane around the bones of their phalanges (where their digits would be) and a shell that lies flat along their backs, giving them a streamlined shape.



The turtle rises and falls in the

water accordin to the rhythm of

The hind flippers are used as oars, pushing

The flippers give a powerful stroke that resembles flight as the turtles



consists of lateral shields that are gray or greenish-gray.

Digit adapted for



GREEN SEA TURTLE SHELL



LEATHERBACK TURTLE SHELL



KEELS



70 TURTLES AND SNAKES **REPTILES AND DINOSAURS 71**

ITVFR

is long and located

along the esophagus.

BLADDER

STOMACH

SPLEEN

REPRODUCTION is sexual, and most

live young.

species lay eggs. Some

species give birth to

HEART

The ventricle has an

incomplete partition.

ESOPHAGUS

LUNG

Internal Structure

nakes are scaly reptiles with long bodies and no legs. Some are poisonous, but others are not. Like all reptiles, they have a spinal column and a skeletal structure composed of a system of vertebrae. The anatomical differences between species reveal information about their habitats and diets—climbing snakes are long and thin, burrowing snakes are shorter and thicker, and sea snakes have flat tails that they use as fins. •

the environment. They do not generate their own body heat.

COLD-BLOODED

Their temperature varies according to

LARGE INTESTINE

Primitive Snakes

EMERALD

TREE BOA Corallus caninus

Boas and pythons were the first snake species to appear on Earth. Many have claws or spurs as vestiges of ancient limbs of their ancestors. They are not poisonous. but they are the largest and strongest snakes. They live in trees, and some, such as the anaconda—a South American boa-live in rivers.

33 feet

TREE BRANCH

are curled around

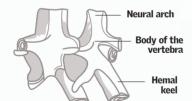
 $(10 \, \text{m})$ LENGTH OF A PYTHON

Spotted Python Antaresia maculosa inhabits the forests of Australia.

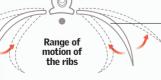
Boas can change color to imitate the branch they

THE SPINAL COLUMN is composed of an assembly of jointed vertebrae with prolongations that protect the nerves and arteries. The system makes them enormously flexible.

VERTEBRAE



FLOATING RIBS allow the body to increase in size.



400 vertebrae the number a snake can have

Floating

SMALL INTESTINE is divided into a small tract and a

ends well before the tip of the tail

Many species of snake have no scales on the underside.

OVARTES The female reproductive organs

INFRARED PITS

Snakes of the family Viperidae are distinguished by two thermoreceptive pits on either side of their heads, which enable them to sense differences in temperature. Some pits are extremely sensitive, helping the snake to gauge the size of its prey when it hunts at night.

IDENTIFICATION OF SOME POISONOUS TAIL Suddenly **AND NONPOISONOUS VIPERS** narrows (like a

rattle) but does Relatively In

NONPOISONOUS -**HEAD** Typically narrow; hard

POTSONOUS

HEAD Typically wide and triangula

SCALES

are generally

found in the

dorsal region.

to distinguish from the neck BODY Narrow, with

smooth scales

TAIL gradually and ends in a point

"Blind" Snakes

Some subtropical and tropical snake species live underground and only come out in droughts or floods. These are the smallest snakes: some are no longer than 4 inches (10 cm). They have large heads, few teeth, and bodies covered in very soft, slippery scales, which enable them to slide into anthills and termite hills, their only sources of food. Their eyes, which are covered with scales, barely work.

TYPES OF MOVEMENT DEPENDING ON HABITAT large tract, which

RECTILINEAR Rainbow Boa

SERPENTINE

King Cobra





Sophisticated Snakes

Snakes of the family Viperidae, as well as other poisonous snakes that appeared later, have highly acute senses and a mouth apparatus with a system of retractable fangs for injecting

GABOON VIPER Bitis gabonica **REPTILES AND DINOSAURS 73**



A Specialized Mouth

he most primitive snakes have heavy skulls and few teeth. Most snakes, however, have lighter skulls and jointed jawbones. These joints are loose and can easily become dislocated so that the snake can swallow prey larger than the natural shape of its own head. The teeth are fixed in the upper jaw or the palate, and the fangs for injecting venom may be located either at the front or at the back of the mouth. Some species, as well as being large and powerful, have retractable fangs, allowing them to close their mouths when their fangs are not in use.

Cranial Anatomy

is directly related to each species' diet and—in the case of venomous snakes—to its system for injecting poison. Most snakes have small skulls with jawbones that can be separated voluntarily by sliding them along a kind of perpendicular rail, which consists of a bone called the quadrate. This greatly increases the size of the snake's mouth.

JACOBSON'S ORGAN

of smell. It consists of two cavities in the palate, into which the snake brings its tongue after "tasting" the outside air. That is why snakes continually stick out their tonques

DUVERNOY'S

This type of skull has small teeth and large, retractable fangs that are thick or

gives the snake an excellent sense

RETRACTOR

FUSED BONES

Rattlesnakes have long, thick fangs that are very sharp and kept folded inside their mouths. A movable joint at the base of the fang enables it to stand upright when the snake's mouth opens to bite.

The venom flows through Entrance directly into

CROSS SECTION The tooth has a cavity that serves as the canal for the

TEETH



GLOTTIS

Primitive Snakes

Boas and pythons are called primitive, since they have neither fangs nor venom. These snakes have several rows of small, inward-curving teeth used for holding prey and swallowing quickly without letting the prey worm out. This feature is necessary for the snakes to be able to hold onto their prey, since they lack venom. Venomous snakes, on the other hand, have little need to worry about their prev escaping, since they know that, after it is injected with the toxic substance, it will not be able to get very far



Injecting Fangs

Cobra species expel their venom in different ways depending on their fangs. The angle and direction of the opening determine how forcefully the liquid is injected.

BLACK AND WHITE COBRA Naja melanoleuca It must bite its prey in order to



Naia nigricolis It has a jaw with a spur, but it does not actually spit.



ASIAN COBRA Naja naja It is the typical cobra, which bites to inject its venom.



RINKHALS SPITTING Hemachatus haemachatus It can spit great distances.



Venom System

activate the injection mechanism.

consists of the two Duvernoy's glands, one on

each side of the skull, which produce venom and

are connected to the fangs. When biting, muscle

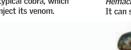
contractions exert pressure on the gland and

This type of skull lacks front fangs Some species are nonvenomous, but others have fangs with a aroove for delivering venom.

In this type of skull, the fangs are located in front, but they are smaller and have only a groove, rather than a canal, for injecting venom.



THE DISTANCE FROM WHICH THE SPITTING **COBRA CAN KILL BY SPRAYING ITS VENOM**



Spitting Venom Forty cobra species can spray their venom

from a distance. They spray in self-defense when they feel threatened. They can direct the stream into an enemy's eyes, causing grave damage or even death. The shape of their fangs is essential to this defense.



NON-SPITTING

The long canal points downward and has a beveled edge at the end. The stream



SPITTING

The canal's opening points forward and is narrow so that it can eject the venom



SOLENOGLYPHS The hollow fangs are the only teeth in the iaw. They are long and retractable and inject venom into the prev's tissues.



PROTEROGLYPHS Small fangs in the front of the jaw, fixed in position and with a rear groove for conducting venom



OPISTHOGLYPHS Fangs in the back, with no must be held in place.

SCALES are soft to

BAND

is also

BACK -

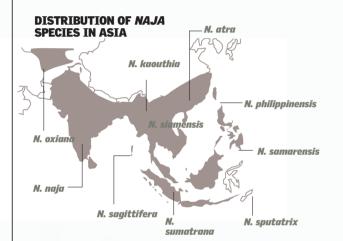
The scales

are closer

distinctive in

Cobras

re an important group of snakes in the family Elapidae. Easily recognized by their outspread hoods, they are well known worldwide, mostly because of their use by snake charmers. Many cobra species carry deadly venom. Some can even spit from several yards away. Cobras of the *Naja* genus are the most widely recognized. They are widespread in Asia and were only recently recognized as 11 separate species. All are predatory; many eat only snakes.





similar to a pair of glasses, which gives this snake its other name: spectacled cobra.

HOW TO DISTINGUISH AMONG THEM

SMOOTH

Cobra species

have smooth

Although the Asian species look similar to one another, they often have distinguishing colors and scale patterns. The simplest way to identify them is by the pattern on their hoods—if you have time to look!





Chinese Cobra



BLACK BAND

species apart.



Red Spitting Cobra

One of 40 species of spitting

cobras, it inhabits the Horn

of Africa, where it is widely

feared. It is distinguished by

a black band below its neck.

Andaman Cobra Naja sagittifera

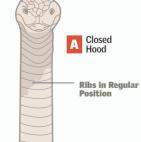
n Cobra Golden Spitting Cobra gittifera Naja sumatrana

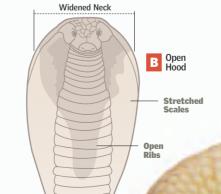
The Hood

Indian Cobra

It is believed that when cobras feel threatened or are about to attack, they spread their hoods by widening their necks in order to look larger than they actually are. The

mechanism involves the ribs, which are widened by the muscles that lie between them. When cobras put on this display, they are ready to strike. Some species also hiss while in this position.





MONOCLED COBRA Naja kaouthia

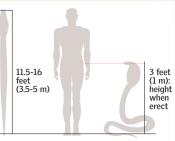
This Asian species has soft scales. Its color varies widely depending on the region.

One of its distinctive traits is the "monocle" on its hood, which gives it its common name.

MONOCLE
Made of two concentric rings, it is easily recognizable because of its white color.

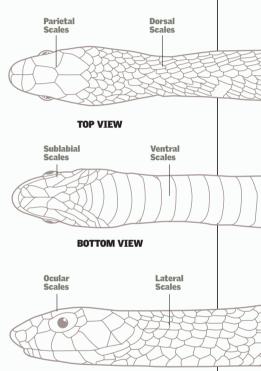
Arrangement of Scales

The appearance of the scales is a simple and easy way to classify species. The large parietal scales follow a line that usually differs among species. The sublabial scales are also widely used in identification. Usually there are five, but the number varies between species. The ventral scales are perhaps most easily used for identification, because they differ notably from one group to another. They are always wide, cover the entire body, and are divided into sections: neck, belly, and tail.



KING COBRA

Ophiophagus hannah
This is the largest cobra, measuring
between 11.5 and 16 feet (3.5-5 m). It
can attack backward and raise its head
more than 3 feet (1 m) above the ground.



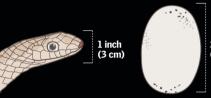
PROFILE

Egg Eaters

he egg-eating snake is both harmless and common. Its body is about as thick as an adult's fourth finger. The egg-eating snake eats bird eggs and hen eggs that are larger than its body. Although it might be confused with a true viper because of its size and coloring, it is classified as an oophagous (egg-eating) snake in the family Dasypeltis. Snakes in this family are distinguished by special vertebrae that help break the shell of an egg as it is swallowed. It selects eggs very carefully, using its highly refined sense of smell to make sure that they are not rotten.

Unique Diet

These snakes do not find eggs every day, so they regurgitate the shells to create more space in their stomachs for the eggs they will find in the future.



(6 cm)

2 inches

The folds in the snake's mouth hold the egg, moving it toward the throat.

> The interlocking scales separate when the skin

is stretched.

The egg slowly enters the mouth until it is completely

SIZE COMPARISON

The egg is two to four times wider than the snake's body.

> The egg is tough and does not break until it reaches the



The snake starts to swallow the egg in successive motions. The jaw opens wider and wider, and the skin on the throat becomes distended.

The throat returns to its normal position.

15 minutes

THE TIME IT TAKES TO **SWALLOW AN EGG**

A valve blocks



The egg reaches the esophageal teeth, which puncture the eggshell; the head and neck muscles then

2 to 4 times

THE EGG CAN BE THIS **MUCH WIDER THAN THE** SNAKE'S MOUTH.



Regurgitation The snake drags its throat along

the ground and arches its spine. Then it raises its head and expels the eggshell by a series of muscle contractions.



Dasypeltis scabra

Southern Africa Habitat Lifestyle Nocturnal Egg-laying Reproduction



1 hour the time it can take to regurgitate the shell

The food is processed in the digestive tract until the large bulge below the head disappears and the animal returns to its normal shape. It forces the eggshell back into its mouth.

It opens its mouth wide

and expels the shell, which

is rolled into a thin cylinder.

Dasypeltis

The name of the genus of egg-eating snakes. Dasypeltis scabra is usually gray or brown with darker marks below its back. It has teeth in its upper jaw, and only three to seven small, rudimentary teeth in the back of its jaw. Its teeth are no obstacle to ingesting

MUSIC IN MARRAKESH

The snake charmers that live in the plaza of this city are famous and evoke scenes from the book *The* Thousand and One Nights.

HEROES AND VILLAINS 82-83

ENCHANTED SNAKES 84-85 ENDANGERED 86-87

DANGER: BAITS AND TRAPS 88-89

FEWER EACH TIME 90-91



ften feared by humans, snakes have long been the object of stories and myths; however, few people know what snakes are actually like. Since snakes

are deaf, when they emerge from a charmer's basket, they are actually following the movement of the flute. Many snake species face extinction from persecution resulting from their

dangerous reputation, their valued skins, and the desire of some to keep them as pets. Most snakes are beneficial to humans because they limit the spread of harmful animals like rats.

the dragon is

CROCODILE

the finest of foods.

There is evidence that, in the 5th

century BC, the Egyptians raised

crocodiles as pets. A crocodile

lived in a tank in the temple of

Sebek and was pampered with

Heroes and Villains

ince time immemorial, reptiles have been the subjects of myths and legends. They have also earned their own space in religious texts, where they are depicted as gods or lesser beings. They may symbolize the incarnation of evil in some cases or divinity in others. The snake and the crocodile, among others, have taken on lives of their own; they play an active role in the stories of many peoples and have been assigned unique, culturally specific meanings.

SNAKES

are what Medusa had on her

MEDUSA

Legend says that those who looked into the eyes of Medusa would be turned to stone for eternity.

Religious Meaning

SNAKE

Snakes hold a special meaning for the Australian

Aborigines and have been depicted in myth both as the wind god and as the protector of people.

The toad, as a symbol in Christianity, appears to be directly related to deadly sins such as greed, lust, and gluttony. In Egypt, crocodiles were venerated, and valuable jewels were given in their honor. The snake is also mentioned in sacred Hebrew texts.

FIERCE

EVE

The snake is associated with trickery and treason in

the Old Testament. It

incited Eve to

enter into sin in

the Garden of

convincing her to eat forbidden fruit.

is the snake that

Aztec serpent from the 15th century, housed in the

QUETZALCÓATL

is the Nahuatl name for the Feathered Serpent. In the Aztec pantheon, Quetzalcóatl was the god of day, the creator of maize, the god of religious ceremonies, and the defender of priests.

SFRF

was a god worshipped by the ancient Egyptians. He had the body of a human being and the head of a crocodile, and he was considered to be the creator of the Nile. It is said that he emerged from the waters of chaos during the creation of the world.

Range

Because they can be found virtually everywhere, reptiles have managed to infiltrate myths all over the world. They were venerated by the Inca and Aztec cultures in the Americas and were the object of legends in every corner of Asia. In China and Japan, the dragon with a snake's body represented earthly power, knowledge, and strength and was the bestower of health and good luck.

Representations

The engraving of a snake biting its tail to form a circle was the emblem of the so-called seal of Solomon that was used by theosophical societies. In Buddhism, the snake represents natural tendencies toward aggression. However, in medicine, it has long been associated with an ancient Greek symbol, the "rod of Asclepius," which had a snake coiled around it. Asclepius was the Greco-Roman god of healing.

SNAKE

The dragon with the body of a snake is invoked in China and Japan to drive away bad spirits.

SIVA

Known in India as the god of destruction, Siva is depicted holding a snake around his neck.

DRAGON

IS TIED TO A SNAKE IN

CHRISTIAN THEOLOGY.

Image found in the Thian Hock Keng Temple in Singapore. In Eastern cultures, the dragon is a mythical animal and can symbolize good as well as evil.

MUMMIFIED

When this crocodile died, it was embalmed and placed in a sarcophagus surrounded by its own hoard of treasures.

obras, as well as vipers and boas (to a lesser degree), are the object of the fascinating performances of snake charmers. In Asia—especially India—snake charmers carry out a very dramatic performance that has been repeated since ancient times. Snake charming has since spread all the way to the Mediterranean coast of Africa. The technique of enchanting snakes requires a knowledge of their weaknesses. For example, it is the movement of the flute, not its actual sound, to which they respond.

A Historical Practice

Revered since antiquity, the charming of snakes is a tradition that had its golden age during the period of imperial expansion, when the West colonized the East. Snake charmers were considered exotic, and they traveled the world and performed at fairs in large cities. They became veritable ambassadors of the East.

Snake charmers assume a crouching position for the performance. snake's body

The flute is brought closer to the basket to call the cobra. Location is key. A cobra cannot reach beyond the portion of its body that is elevated.

In 2004, snake charmers in India were able to resume their jobs after having been accused of mistreating their animals during their shows.

shadows. This causes the snakes to be less active, because they are not being warmed by the sun.

The movement of the flute incites the cobra to extend its body.

The flute is called a *been*

At the moment of greatest bodily extension, the cobra performs a dance that climaxes with the snake charmer kissing it on the top of its head. The practice of snake charming is passed from fathers to sons. In

A FAMILY TRADITION

Its movement, not its sound, enchants the snake. Cobras, like all snakes, are deaf.

Cobras are usually used, but vipers and even boas can serve

Unlike vipers, cobras are not capable of striking from a coiled position. This keeps them from attacking beyond the reach of the extended portion of their bodies.



1/3 of its Body

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Endangered

SEA TURTL

Caretta

Tropical Waters

4 feet (120 cm)

The loggerhead is a marine turtle that inhabits the coasts of tropical seas and can

migrate great distances during its reproductive period. It lives in deep waters but is sometimes found near the shore. It is carnivorous but obtains food from a variety of

sources depending on its age.

caretta

arine turtles are in danger of extinction. Their need to leave the water to breathe makes them very easy to catch. Females and their offspring are at the greatest risk because they build exposed nests on the shore where they can easily be attacked by hunters and egg collectors. Others die when they are trapped in fishing nets. Marine turtles' nesting sites are also at risk because of the effects of coastal urbanization. Artificial light drives females from the routes they naturally take to lay their eggs. The offspring suffer from the same problem and become confused, unable to find their way.



HAWKSBILL TURTLE Eretmochelys imbricata

Status	Critical
Habitat	Warm Atlantic
Size	2 to 2.5 feet (60-80 cm)

The hawksbill is one of the smallest sea turtles and is easily recognized by its shell, which has a central keel and toothed edges. The beautiful designs on their shells have caused this species to be savagely hunted. Hawksbills have a long life span and migrate less than other marine species.



LEATHERBACK **SEA TURTLE** Dermochelys coriacea

tatus	Endangered
abitat	Tropical Waters
ize	4 to 6 feet (1.3-1.8 m)

The leatherback, the largest marine turtle, is one of the world's foremost migratory animals: it routinely crosses the Atlantic Ocean. The beaches where they nest and lay their eggs are now threatened by development related to



MESOAMERICAN RIVER TURTLE Dermatemys mawii

Status	Endangered
Habitat	Central America and Mexico
Size	1.5 to 2 feet (50-65 cm)

Although turtles have developed adaptations for swimming, such as palmshaped feet and a hydrodynamic shell, they are practically defenseless on land. They have very short tails, and the females have olive green coloring on the upper portions of their heads. They lay between six and 20 eggs in the marshy banks of rivers and are hunted by coypu (nutria) and humans.



GREEN SEA TURTLE Chelonia mydas

itatus	Endangered
labitat	Tropical Waters
iize	3 feet (1 m)

The green sea turtle is one of the most common sea turtles. It is found in the world. It has been a primary victim of commercial fishing. Green sea turtles are also in peril because of changing conditions on the beaches where they mate.



PACIFIC **RIDLEY** Lepidochelys olivacea

Status	Endangered
Habitat	Gulf of Mexico
Size	1.5 to 2.5 feet (50-75 cm

The Pacific ridley (olive ridley) has a round-shaped greenish-gray shell with similar to that of a parrot, and its preferred diet consists of crustaceans and benthic mollusks. It is the smallest of the sea turtles and the species under the greatest threat of extinction.



PANCAKE **TORTOISE** Malacochersus tornieri

Status	Vulnerable
Habitat	East Africa
Size	5.5 to 7 inches (14-17 cm)

The shell of the pancake tortoise is not only very flat but also very flexible because of the openings in the bone on its underside. This feature allows it to crawl into narrow cracks to escape from predatory birds and mammals. It can also squeeze itself into holes.



to reach the beaches where they will lay their eggs. The Laud turtle is capable of crossing the entire Atlantic Ocean.



GALAPAGOS TORTOISE Geochelone nigra

Status	Vulnerable
Habitat	Galapagos Islands
Size	Up to 4 feet (1.2 m)

The shell and other characteristics of these tortoises have evolved in distinctive manners according to the conditions of each island where the species is found—especially conditions of climate and nutrition. Many have developed overgrown extremities to reach their food. They can no longer be



YELLOW-MARGINED **BOX TURTLE**

Cuora flavomarginata

8 inches (20 cm)

The population of this turtle has decreased significantly in recent decades because of the expansion of agriculture. The population remaining in Taiwan has stabilized and now shows signs of recovery. Those in China, on the other hand, remain in



Danger: Baits and Traps

ea turtles are in danger of extinction. During their migrations, they eat the bait set on hooks intended for tuna. As the turtles fight to free themselves from the hooks, they damage their internal organs and lose their buoyancy, which causes them to die from asphyxiation. Fishing nets are also mortal traps for sea turtles. Certain governmental and private organizations are seeking ways to reduce the danger for these turtles and their future offspring.

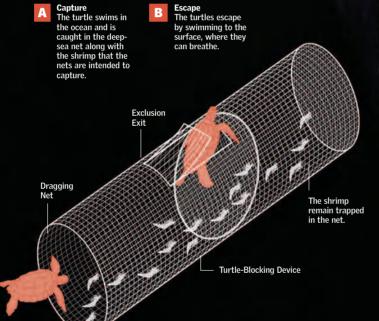
Turtle Excluder Devices (TED)

Sea turtles, such as the Laud, lay eggs on the Atlantic coasts of French Guiana and Suriname. They can only make it there, however, if they overcome the obstacle of deep fishing nets in the sea. To help them overcome this threat without interrupting the fishing of shrimp, nets have been developed with devices that exclude turtles from capture.

TED EFFICIENCY

of turtles can escape from fishing nets using Turtle Excluder

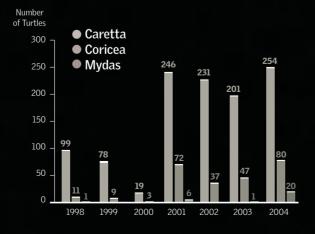
escape only with difficulty or



PROTECTION FOR TURTLE EGGS

The presence of humans on beaches interferes with the development of turtle offspring. In order to preserve turtles, countries have joined forces with environmental nongovernmental organizations to carry out different tasks. In Suriname, people gather the eggs to protect them from illegal traffickers and corral the nests so that tourists do not destroy them. In the Caribbean basin of Costa Rica, Tortuguero National Park was established in the region home to the greatest amount of spawning green turtles.





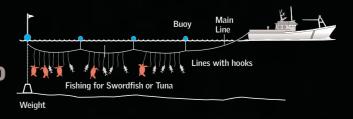
a 60 to 90%

reduction in captures has been achieved with the use of circular hooks.

Long-Line Fishing

eat bait. Because they cannot escape, they die of

over 3,000 The number of hooks on a single main line



Uncontrolled Tortoise shells

COMMERCIAL USES

exploitation of are taken to turtles occurs to support jewels and



LONG HOOK Turtles are able to

swallow these hooks, die of internal hemorrhaging or asphyxiation.



CIRCULAR HOOK

The greater width of these hooks reduces the chance of turtles being caught on them or swallowing them. Thanks to this modification, the numbers of turtles caught or injured has been dramatically reduced.



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FIJI CRESTED

Habitat Loss

THE LOSS OF HABITAT CAUSED BY HUMAN ACTIVITIES IS THE MAIN CAUSE OF REPTILE EXTINCTION.

Fewer Each Time

any species of reptiles are at serious risk of extinction—mostly because of habitat loss caused by human activities. The most threatened species with the fewest resources for recovery are those native to islands, which are unable to emigrate or adapt to rapidly changing conditions. Urban growth, deforestation, and water contamination are among the principal forces that have created this critical situation. Conscious of the problem, many countries have developed legislation to protect reptiles, but it is not always effective.



ARUBA ISLAND RATTLESNAKE

Status	Critical
Habitat	Aruba
Size	3 feet (95 cm)

This rare, little-known species of rattlesnake inhabits an area of Aruba of roughly 30 square miles (76 sq km). Its current status as a critically endangered species is mostly due to the loss of its ecosystem. Between 1993 and 2004, only 185 specimens were sighted in the wild. Arikok National Park is currently developing programs for the snake's conservation.



GOLDEN **FER-DE-LANCE** Bothrops insularis

Status	Critical
Habitat	Brazil
Size	2.6 feet (80 cm)

This viper inhabits just one small island on the Brazilian coast, only 106 acres (43 ha) in size, called Queimada Grande.

Deforestation is its main threat. Although the snake's population is stable, the loss of its natural habitat places it in critical danger of extinction.



HIERRO GIANT LIZARD Gallotia simonyi

Status	Critical
Habitat	Canary Islands
Maximum Size	2 feet (60 cm)

This lizard inhabits the rocky outcroppings of El Hierro, one of the Canary Islands. Over recent decades, it was estimated that only 200 specimens remained, although the exact number is unknown. Its main cause of extinction is habitat loss and lack of food rising from competition with goats Today these lizards are protected, and their nbers are recovering in preserves



JAMAICA Alsophis ater

tatus	Critical
abitat	Jamaica
ize	2.8 feet (85 cm)

This reptile-eating snake inhabits the mountains of Jamaica. It is not venomous and it is known for its great speed. Since 1994, it has been considered at critical risk of extinction because of habitat loss. Very few wild specimens have been sighted. Some experts believe that it may already be extinct.



TURKS AND CAICOS ROCK IGUANA Cyclura carinata

Status	Critical
Habitat	Bahamas
Size	14 inches (36 cm)

Since the 1970s, nearly 13 subpopulations of iguanas have disappeared. Only one important species of this family of iguana remains, living in an area of 5 square miles (13 sq km) on a privately owned island. Its main threats come from predators introduced by humans and from habitat loss caused by urbanization.



CAPE DWARF CHAMELEON

	Status	Critical	
g	Habitat	South Africa	
ž	Maximum Size	8 inches (20 cm	



ALLIGATOR

Status	Critical
Habitat	China
Maximun Size	6 feet (2 m)

BULGARDAGH Vipera bulgardaghica

Status	Critical
Habitat	Turkey
Size	2.6 feet (80 cm)

This venomous, rodent-eating snake lives mostly in Anatolia. There its main threats are illegal trafficking and other human act inegal trainesting and other manaca activities. Although awarded protected status in the region's animal preserves since 1994, it remains at serious risk o



CRESTED

ARUBA ISLAND

RATTLESNAKE

Crotalus unicolor

Status	Critical	
Habitat	Fiji	
Size	2.5 feet (75 cm)	

92 GLOSSARY

Glossary

Adaptation

Trait of an organism's structure, physiology, or behavior that enables it to live in its environment.

Alkaline

Substances that increase the number of hydroxide ions (OH⁻) in a solution; having a pH greater than 7; basic; opposite of acidic.

Amino Acid

Organic molecule containing nitrogen in the form of ammonia (NH2⁻) and a carboxyl group (COOH⁻) joined to the same carbon atom. They form the building blocks of protein molecules.

Amphibian

Group of animals that today includes frogs, toads, salamanders, and limbless caecilians.

Ancestor

Parent, grandparent, or more remote forebear that transmits certain genetic characteristics to its descendants.

Antidote

Substance that neutralizes the action of a specific poison.

Antipoisonous Serum

Specially prepared substance used to neutralize toxins from the bite of a specific snake in persons who show signs of poisoning.

Aorta

Main artery in blood circulation systems. It sends blood to other tissues of the body.

Biped

Animal that stands upright, walks, or runs using only the two hind limbs.

Carbon-14

Radioactive carbon isotope whose concentration can help determine the age of fossils.

Carboniferous

Geological period during the Paleozoic Era, which took place between 360 and 251 million years ago.

Carnivore

Animal that obtains its nutrients and energy by eating flesh.

Carrion Eater

Animal that eats the flesh of a dead animal.

Cellular Membrane

Flexible lipid envelope covering all living cells. It contains cytoplasm and regulates the interchange of water and gases with the environment.

Cerebellum

A section of the brain in vertebrates located above the brain stem and behind and below the cerebrum. It coordinates muscular activity and maintains balance.

Chelonia

Collective term for land and sea turtles.

Chordate

Animal that belongs to the phylum Chordata; any animal having a spinal cord, whether throughout its development or only in certain stages. Animals that are not chordates are called invertebrates.

Chromosome

Structure that carries the genes and, in eukaryotic cells, is composed of filaments of chromatin that contract during mitosis and meiosis.

Class

Taxonomic group above order and below phylum. For example, the class Reptilia, within the phylum Chordata, contains orders such as Squamata and suborders such as Sauria.

Cloaca

Exit chamber of the digestive tract of reptiles and birds. In some species, it also functions as the site of the reproductive and excretory systems.

Cold-blooded

Organism whose body temperature is mainly controlled by an external heat source because it has little capacity to generate its own heat through its metabolism.

Connective Tissue

Tissue that joins, supports, and protects the other three types of tissues: epithelial, muscular, and nervous. It contains a network composed of many fibers surrounding the cells.

Coprolite

Fossilized animal excrement.

Cytoplasm

Fluid within the cell membrane.

Dental Battery

Set of teeth joined together to form a cutting and grinding surface.

Dermis

Internal layer of skin, located under the epidermis.

Dewlap

Fold of skin hanging below the chin and extending to the chest in some lizards and other tetrapods. It can be unfolded in territorial battles to intimidate or to display certain moods.

DNA

Deoxyribonucleic acid. Double-helix shaped molecule that contains encoded genetic information.

Duvernoy's Glands

System possessed by some snakes for injecting venom. They are a pair of modified salivary glands, one on either side of the head.

Efferent

Nerve or blood vessel that flows from a central point toward peripheral tissues or organs.

Egg

Fertilized ovule that develops into a new individual. It usually also refers to the entire structure that covers and protects the fertilized ovule.

Embryo

The first stage of development of a multicellular animal or plant.

Estivation

State of extreme lethargy or inactivity caused by prolonged periods of drought or excessive heat.

Evolution

Changes in the gene pool of a population caused by processes such as mutation, natural selection, and genetic drift.

Family

Taxonomic category lower than order and higher than genus. The family Viperidae, for example, groups together the vipers.

Fertilization

The joining of a female sex cell with a male sex cell to form a diploid zygote.

Fossil

Remains of various types of ancient life-forms, both plants and animals, in a rocky substrate. They are found in the geological strata of the Earth's surface.

Fossilization

Process by which a deceased organism becomes a fossil over thousands of years.

Gastrolith

Stone found in the stomachs of certain herbivorous dinosaurs that helped them crush and digest food.

Gene

Unit of information in a chromosome; sequence of nucleotides in the DNA molecule that carries out a specific function.

Genetic Drift

Change in the frequency of alleles, the result of random processes.

Genus

Taxonomic category that includes species.

Gills

Respiratory organs of aquatic animals. Often an extension of fine tissues from the outer surface of the body or, in vertebrates, from part of the digestive tract.

Gland

Group of epithelial cells that produce secretions, organized inside a covering membrane to form an organ whose function is to synthesize and excrete molecules that the organ itself does not use.

Gonads

Glands that produce reproductive sex cells.

Gondwana

Ancient southern supercontinent that broke up 180 million years ago to form Africa, South America, Australia, Antarctica, and India.

Gregarious

Animal whose typical behavior, as a species, is conducive to living in groups.

Herbivore

Animal that feeds on grass or other plants.

Inflammation

Nonspecific defensive reaction of the body to the invasion of a foreign substance or organism, frequently accompanied by the accumulation of pus and an increase in the temperature of the affected area

Jacobson's Organ

Organ on the upper part of the palate that takes in substances captured by a reptile's tongue and analyzes them to determine various characteristics of the object they come from. Also called the vomeronasal organ.

Lability

Fragility of an organ; sensitivity to potentially destructive agents.

Lamarck, Jean-Baptiste

French naturalist (1744-1829). He was the first to propose a theory to explain the changes in living beings.

Laurasia

Ancient northern supercontinent formed of North America, Europe, and Asia, excluding India.

Lipids

Group of water-insoluble substances, including fats, oils, waxes, steroids, glycolipids, phospholipids, and carotenes.

94 GLOSSARY

Mammals

Vertebrate animals whose females have mammary glands, which secrete substances that serve as food for their young.

Mass Extinction

Brief geological interval in which the extinction rate is greatly increased, affecting a large number of species and causing a considerable reduction of biodiversity.

Metabolism

The sum of all the physical and chemical transformations that occur within a cell or organism.

Mimicry

A superficial similarity in shape, color, or behavior on the part of certain organisms (mimetics) to others (models) or to objects in the environment for the purpose of hiding, seeking protection, or some other benefit.

Mitosis

Nuclear cell division, in which two daughter nuclei are formed that are identical to the parent nucleus.

Molars

Group of teeth that crush food within the mouth.

Molecular Clock

Marker used to estimate the evolutionary distance between two species. It is evaluated by comparing the gradual accumulation of amino acids between the proteins of those species.

Nucleic Acid

Molecule carrying the genetic information of a cell.

Omnivore

Animal that feeds on animal and plant species

Opisthoglyph

Group of snakes with fangs located in the back of the upper jaw and smaller teeth in front. The fangs can be smooth or have a groove on the surface that enables secretions to flow into the wound they produced.

Order

Taxonomic category below class and above suborder and family. For example, snakes and saurian reptiles belong to the order Squamata

Ovary

Organ that produces eggs (female sex cells).

Oviparous

Animal that reproduces by laying eggs.

Ovoviviparous

Animal that reproduces by forming eggs that are carried, with soft shells, inside the female until they hatch. They may hatch inside the mother and come out as if they had been born live or be expelled from the egg pouch, breaking its membrane in order to hatch.

Ovum

A female haploid reproductive cell. It contains half as many chromosomes as the parent cell.

Parasite

Organism that lives at the expense of another and typically obtains nutrients that have already been processed by the host.

Parthenogenesis

Form of asexual reproduction in certain species, such as the gecko, in which the females produce young (all or mostly females) without the intervention of a male

Pheromones

Chemical substances secreted by the reproductive glands of certain animals in order to attract individuals of the opposite sex.

Photoperiod

Relative length of night and day that enables organisms to measure the change of seasons and that influences their behavior and physiology.

Phylogeny

Evolutionary history of any taxonomic group. Usually represented as a branching tree.

Piscivore

Animal that eats only fish.

Plastron

Lower part of the shell of a turtle or tortoise.

Predator

Animal that captures and eats other animals as prey.

Protein

Macromolecule composed of one or more chains of amino acids. They define the physical characteristics of an organism and, when acting as enzymes, regulate chemical reactions.

Proteroglyph

System of fangs in cobras, mambas, coral snakes, and sea snakes; or the name referring to the group that contains these types of snakes. The fangs are located in the front of the upper jaw and are hollow or have a surface groove for carrying venom. They are relatively short and are fixed in an extended position.

Protractile

Describes a type of reptilian tongue that can be voluntarily hurled outward in an extremely rapid, precise movement.

Reabsorption

Process in which substances that are filtered or secreted by the kidneys and which are necessary for maintaining the organism's internal equilibrium are reincorporated into the plasma.

Reflex

Simple action of the nervous system that involves a sensory neuron, often one or more interneurons, and one or more motor neurons.

Sensory Receptors

Cells, tissues, or organs that detect internal or external stimuli

Sexual Reproduction

Reproduction based on the fertilization of a female sex cell by a male sex cell, resulting in the production of descendants different from either parent.

Shedding

Sloughing off or change of skin, a process that happens naturally in many reptiles.

Smooth Muscle

Non-striated muscle that covers the walls of the hollow organs and arteries and is controlled involuntarily.

Solenoglyph

System of long, hollow fangs in some snakes or the name of the group that refers to snakes possessing this characteristic. The fangs are the only teeth in the upper jaw, and they pivot so that they lie flat along the roof of the mouth when the mouth is closed. They inject venom deep into the tissues of prey.

Species

Biological concept of a group of organisms that can or do interbreed in the wild and are reproductively isolated from other similar groups. This biological concept should be distinguished from the concept of a species as a category and as a taxon.

Sperm Cell

Mature male sex cell, which is typically mobile and smaller than the female sex cell.

Spinal Cord

Part of the central nervous system of vertebrates, surrounded by the spinal column.

Striated Muscle

Muscle tissue with a striped appearance that shows the arrangement of the contracting elements. Includes the voluntary skeletal muscle and the cardiac muscle.

Thalamus

Part of the prosencephalon of vertebrates located behind and below the cerebrum. It is the main connection center between the brain stem and the upper cerebral regions.

Thermoregulation

Ability of reptiles to change their body temperature by moving from a warm place to a cooler one or vice versa.

Tissue

Group of identical cells that carry out a common function

Trophic Level

The position of a species in the food web or food chain.

Uric Acid

Water-insoluble nitrogenated waste product; the main component of the excrement of reptiles and insects.

Vertebrates

Animals with a spinal column that provides a structural axis and develops around the notochord, completely replacing it in most species.

Viviparous

Animal species whose females do not lay eggs and whose young are born live.

Warm-blooded

Organism whose main heat source is internal and is produced largely through oxidative metabolism.

Zoonosis

Illness transmitted by animals to humans.

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