Welcome to the world of birds. No matter how you approach it, this is a wonderful book not only for its pictures, splendid illustrations, size and format but also because, as you read it, you will discover secrets about these inhabitants of the Earth, which, according to the history of evolution, came into being before humans. The text is written in a direct, easy-to-understand style. Most birds have a much-envied ability that has inspired poems and all types of experiments: they can fly. This enables them to see the Earth from afar, with its seas, mountains, rivers, cities, and other features. It has been estimated that more than 200 million birds migrate each year, all over the planet. Many of them fly thousands of miles, crossing desolate deserts and windy seas to arrive in Africa or Antarctica. Some find their way using the sun, the moon, and the stars; others follow their parents or use the course of rivers or mountain chains as references. In general, smaller birds migrating across continents stop several times to get food. It is surprising how fast they travel, in spite of these stops: it has been calculated that some small species cover almost 2,500 miles (4,000 km) in five or six days. Several studies have shown that carrier pigeons and white-headed sparrows, for example, can travel more than 600 miles (1,000 km) per day. Some ducks, such as the blue-winged teal, complete their trip from Canada to central Mexico in about 35 days, making several stops to feed along the way.

Birds never cease to amaze us, whether hiding in trees, flying over high mountaintops, or nesting in Antarctica or on tall buildings. Perhaps the reason for such amazement is their behavior, which continues to be a mystery to human beings, as well as the differences among them. It is believed that there are approximately 9,700 living bird species in the world—more species than in any other vertebrate group except for fish. Once they reach adulthood, birds’ weight varies from a mere 0.06 ounce (1.6 g), in the case of hummingbirds, to as much as 330 pounds (150 kg) for African ostriches. Even though most birds fly, there are some—such as kiwis, rheas, and ostriches—that run quickly on the ground. Some birds, being perfectly adapted to aquatic life, live in oceans, rivers, and lakes. The shape of their feet and bills varies according to the environment in which they live. Some aquatic species have bills modified to filter small water particles, whereas birds of prey have strong bent bills to hold down and tear apart their prey. What is the diet of birds based on? Because of their great diversity and wide distribution, their diets differ greatly. In general, birds eat a bit of everything, although insects are the most important element of their diet. They eat fruit, seeds, nectar, pollen, leaves, carrion, and other vertebrates. Most birds lay their eggs in nests. Worthy of mention is the protective attitude that both males and females have toward their young. Adult birds care for their chicks, warn and protect them against the danger of predators, and guide them to safe places where they can live and feed. We invite you to investigate up close the world of these fascinating beings that are able to run, climb, swim, dive, and cross the skies.

A Universe of Birds

White Heron

(Egretta alba)

A species easy to distinguish in the proximity of rivers, lakes, and lagoons.
The Nature of Birds

Many scientists maintain that birds descended from dinosaurs because fossils of dinosaur specimens with feathers have been found.

As a group, birds have exceptional eyesight—they have the largest eyes in relation to the size of their bodies. In addition, they have very light bones, which are suitable for flight. Just like their bills, birds’ feet have also changed in accordance with the functions and particular needs of each species. For instance, walking birds—like other vertebrate groups—display a marked tendency toward having a reduced number of toes; ostriches, for example, have only two. Some birds of prey, such as eagles, have feet that are veritable hooks.
Beyond Feathers

Defining what a bird is brings to mind an animal covered with feathers that has a toothless bill and anterior extremities morphed into wings. Other distinguishing characteristics are that they are warm-blooded and have pneumatic bones—bones filled with air chambers instead of marrow. Birds have very efficient circulatory and respiratory systems and great neuromuscular and sensory coordination.

Variety and Uniformity

We can find birds in every type of environment: aquatic, arid, and tropical zones. Their adaptation to the environment has been very successful. Nevertheless, birds are one of the groups that display the fewest differences among their members.

Adaptation to Flying

Some crucial anatomic and physiological characteristics explain birds’ ability to fly. Their bodies and feathers reduce friction with the air and improve lift. Their strong muscles, light bones, air sacs, and closed double circulatory system also play a role in their ability to fly.

FEATHERS

Unique. No other living animal has them. They are appealing for their structure, variety, and constant renewal.

WINGS

Propel, maintain, and guide birds during flight. They have modified bones and characteristic plumage.

FEET

Birds walk on their toes. In general, they have three toes pointing forward and one pointing backward.

EYE

Great visual acuteness and well-developed hearing.

High Metabolism

The high demands of flying are compensated by a high metabolic rate. Birds extract as many nutrients from food as they can.

STRUCTURE

Balance in movement. A bird’s internal architecture contributes to its stability. The location of its feet and wings helps to concentrate its weight close to its center of gravity.

SENIOR

Great visual acuteness and well-developed hearing.

BILL

Originates in the epidermis. It is hard and resistant, with a consistency similar to that of horns. It grows continuously, like nails and feathers.

IDENTIFICATION

There are differences in plumage and skin that make it possible to identify birds. The bill, because of its variations, also helps to establish bird groups.

High Metabolism

The high demands of flying are compensated by a high metabolic rate. Birds extract as many nutrients from food as they can.

SONGBIRDS

Passeriformes, or passerines, form the most numerous group among birds; they are characterized by a well-developed syrinx that enables them to emit harmonious songs and trills and by a soft plumage of varied colors. Because of their brain development, it is believed that passerines were the most recent birds to come into existence.
The evolution of birds is a debated theme in science. The most widespread theory states that birds descend from theropods, dinosaurs that walked on two legs. Fossils of dinosaur specimens with feathers have been found, but Archaeopteryx, a primitive bird that lived 150 million years ago, is the oldest relative known. Completely covered with feathers, it had a pair of wings that enabled it to fly. However, it retained many dinosaur traits.

**Fossils**

Several fossil samples were found between 1861 and 1993. The first one, found in Bavaria, Germany, was very important because its discovery coincided with the publication of *On the Origin of Species* by Charles Darwin, at a time when the search for evolutionary “missing links” fascinated scientists. The original is located in the British Museum. Another fossil, which includes the head, is in the Berlin Museum.

**The Nature of Birds**

Birds have greater mobility than Archaeopteryx. Its movements were limited by its shoulder joint, which was placed forward. Birds have greater mobility than Archaeopteryx.

**From Arms to Wings**

It had a greater range of motion in the upper limbs than primitive dinosaurs.

**Three Toe with Talons**

The hand has three extended fingers, each of which is equipped with a sharp curved talon.

**Wrist**

Its wrist joint was more flexible than that of modern birds, a trait it shared with dinosaurs.

**Vertebrate Tail**

Composed of 21 or 22 pieces. Modern birds have tail vertebrae that are fused together into a single bone called the pygostyle.

**During Flight**

During flight, it functioned as a rudder. On the ground, it provided balance for walking.

**Toes**

The foot is functionally tridactyl. Its first toe (hallux), which usually points backward and typically does not touch the ground, is opposable, like that of modern birds (it can move in a direction perpendicular to toes II, III, and IV).

**Archaeopteryx lithographica**

**Brain**

Similar to that of present-day reptiles and early theropods. The arrangement of the brain and ears reveals that it had a good sense of orientation and that it was able to perform complicated maneuvers.

**Furcula (Merged Collarbones)**

Shaped like a boomerang, as in many theropods.

**Archaeopteryx**

150 million years ago

**Order**

Saurischians

**Suborder**

Theropods

**Diet**

Carnivore

**Length**

10 inches (25 cm)

**Height**

8 to 12 inches (20-30 cm)

**Weight**

18 ounces (500 g)

**Archaeopteryx**

From the Jurassic Period

**Archaeopteryx lithographica**

**Modern Bird**

**Archaeopteryx**

**Brain**

**Furcula**

(Merged Collarbones)

**Archaeopteryx**

**150 million years ago**

**Modern Bird**

**Brain**

**Furcula**

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**Archaeopteryx**

**150 million years ago**

**Modern Bird**

**Brain**

**Furcula**

(Merged Collarbones)
Skeleton and Musculature

Both lightweight and resistant, the skeleton of birds underwent important changes in order to adapt to flight. Some bones, like those of the skull and wings, fused to become lighter. Birds have fewer bones than other vertebrates. Because their bones are hollow, containing internal air chambers, the total weight of their bones is less than that of their feathers. Birds’ spines tend to be very flexible in the cervical region and rigid near the rib cage, where a large, curved frontal bone called the sternum attaches. The sternum features a large keel, to which the pectoral muscles attach. These large, strong muscles are used for flapping the wings. In contrast, running birds, such as ostriches, have more developed muscles in their legs.

Skull
Light because of the fusing of bones, the skull does not have teeth, a bony jaw, or grinding muscles.

Hummingbird
Because of its adaptation to stationary flight, its pectoral muscles can account for 40 percent of its total weight.

Cervical Vertebrae
Their number varies according to the type of bird. They make the neck flexible.

Eye Socket

Coracoids

Feet
Birds have four toes, just like their ancestors, the reptiles.

Humerus
Coracoids

Legs

UPPER MANDBLE OF BILL
In some species, it is flexible.

LOWER MANDBLE OF BILL
It is flexible, allowing birds to open their mouths wide.

Wings
Without a doubt, wings are the greatest adaptation of birds. Strong tendons travel through the wings and merge into the hand bones, where the feathers are attached.

Flapping Wings
Flying demands an enormous amount of energy and strength. Consequently, the muscles responsible for flapping the wings become very large, easily comprising 15 percent of the weight of a flying bird. Two pairs of pectorals, in which one muscle of the pair is larger than the other, work to raise and lower the wings. They function synergistically and in opposition to each other when one contracts, the other relaxes. Their placement within the thoracic cavity corresponds roughly to the bird’s center of gravity. The motion of the wings also requires strong tendons.

1. The descending flapping of the wings takes place.
2. The smaller pectorals contract and draw the wings inward.

1. The larger pectorals contract.
2. The pectoral muscles relax.

The Color of the Flesh
The color of the flesh depends on the blood circulation in the muscles. The more circulation, the redder the flesh. Flying birds have red flesh, whereas nonflying birds, such as chickens, have white flesh.

The Nature of Birds

Pneumatic Bones
Many of a bird’s bones are pneumatic—that is, they are full of air instead of bone marrow. Some bones even have prolongations of air sacs. The bones may look fragile at first glance, but their incredible strength comes from a network of internal trabeculae (spongy bone structures), which resemble the trusses of a metal bridge.

THE NATURE OF BIRDS

THE NATURE OF BIRDS