April 2021

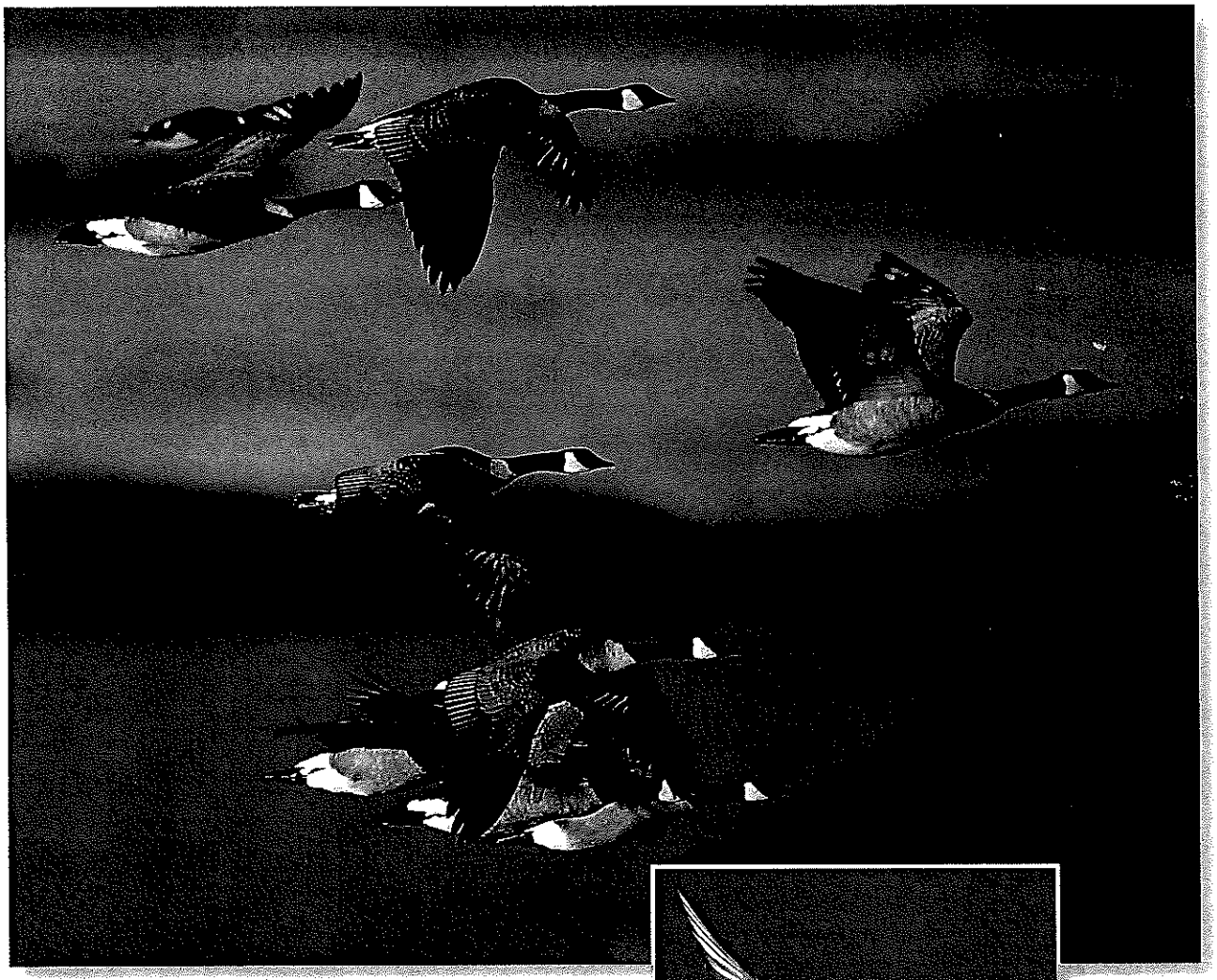
Birds - Masters of Flight

Center for Urban Resilience

BIRDS: MASTERS OF FLIGHT

CARD 7

• GROUP 6 •
EXPLORING BEHAVIOR



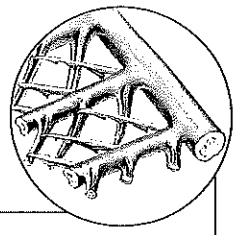
KEY FEATURES

- Almost every aspect of a bird's body features an adaptation for flight
- Even flightless birds (penguins and ostriches) evolved from ancestors that could once fly
- Some birds, such as swifts and frigatebirds, spend almost all their lives in the air

▲ ABOVE: Canada geese.
◄ LEFT: Arctic terns fly 24,000 miles on migration each year.

ROFILE How Birds Fly

Birds can fly due to a unique combination of features — strong but lightweight bones, a covering of feathers and an extremely efficient energy-providing system.

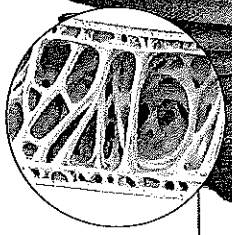


Alula

A slat formed by small feathers attached to the 'thumb' smooths airflow over the wing, reducing the risk of stalling at low speeds.

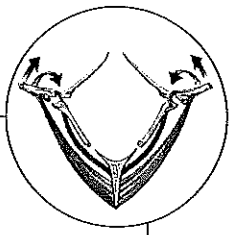
Feathers

A feather is made up of hundreds of parallel barbs on either side of a central shaft, locked together by tiny barbules *(top)*. A single feather may have over a million barbules.



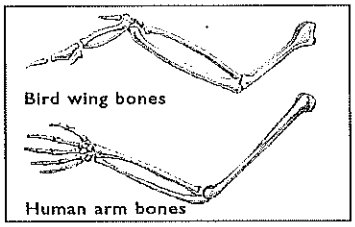
Bones

A bird's bones are extremely strong but very light. As a weight-saving feature, many of the bones have a honeycomb structure, with hollow, air-filled centers braced by slender struts.



Muscle Power

Two sets of huge muscles that are anchored to the breastbone and pull on the upper arm bone (humerus) of the wing aid flapping. Larger *pectoralis* muscles power wings on the downward thrust. Smaller *supra coracoideus* muscles work via a pulley system of tendons to raise wings on the upstroke. In powerful fliers, the flight muscles account for one-third of the birds' total bodyweight.



Comparison of Bones

Bird wing bones are specialized. Upper bones are short in birds that flap fast, long in gliding birds. 'Wrist' and 'hand' bones are elongated and fused together to support the primary flight feathers.

THE PRINCIPLE OF FLIGHT

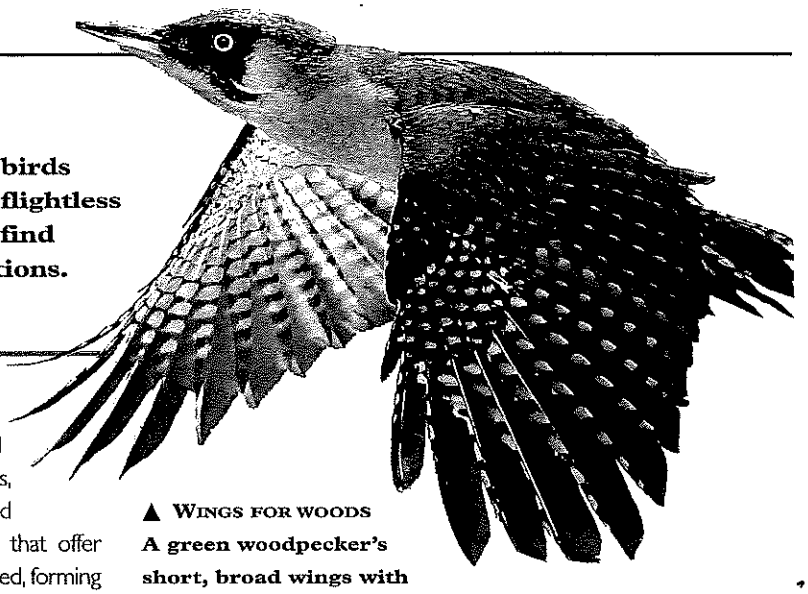
To fly, a bird must overcome the grounding effect of gravity and, once in the air, the resistance of air flowing over its body or 'drag.' Wings provide solutions to these problems. From the side, a bird's wing has an 'aerofoil' shape with a convex upper surface and concave under surface. As it moves forward, the air has farther to travel over the top than underneath. This means there is less air pressure on top than there is beneath it; the higher pressure from below pushes the bird upwards, in a process called 'lift.' Once airborne, the airflow over the wing is then smoothed and controlled by feathers that twist and flex.

PERSPECTIVE

● Feathers are made of keratin, the same tough material of human hair and nails. They contain a great deal of air and are very light but strong and rigid. Birds evolved from reptiles and feathers evolved from scales, which are also made of keratin.

INSIGHT

More than any other group of animals, birds have mastered flight. Apart from a few flightless species, birds use the power of flight to find food, escape enemies or for long migrations.

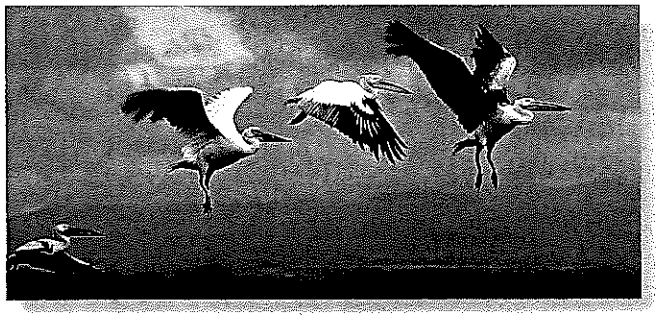


▲ **WINGS FOR WOODS**
A green woodpecker's short, broad wings with slotted tips allow tight turns.

FOCUS

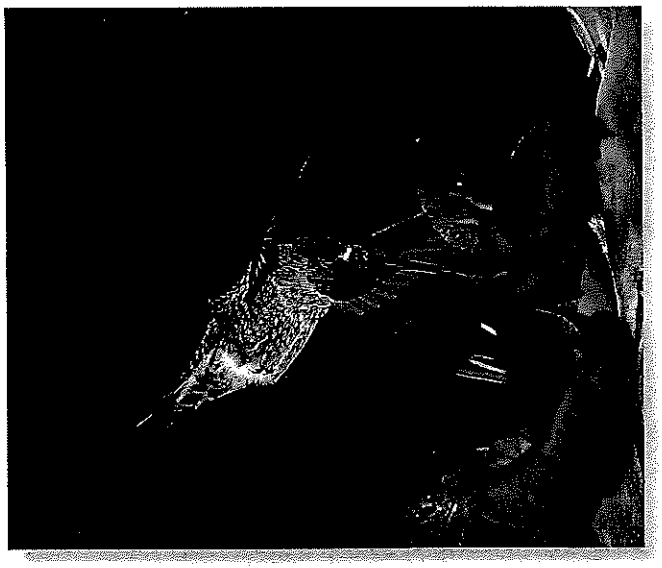
Different kinds of birds fly in distinct ways, depending on habitat and lifestyle. The wing shape reveals a great deal about the way in which a particular bird flies. Perching birds, such as thrushes and warblers, as well as pheasants and other gamebirds, have short, broad, roughly oval wings that offer rapid lift on take-off. The wingtip feathers are often separated, forming slots that give them great maneuverability in woodlands.

Storks, pelicans, vultures, eagles and buzzards have very long, broad wings with widely slotted tips to soar high over land. Albatrosses and shearwaters have very long, slender wings, like those of gliders, enabling them to travel vast distances with little effort in the wind over the sea. Others, such as falcons, sandpipers, terns, swifts and swallows, have long, slim, swept-back wings with pointed tips, which allow them to fly at great speed and with great agility when migrating or catching food.



▶ **PELICAN POWER**
White pelicans are heavy birds but powerful fliers with long, broad wings.

HOVERING



Many birds, from kingfishers to owls, can hover briefly, though most do so rather clumsily. In others, hovering is more sustained, but only with the wind's help. To remain stationary, they must fly into the wind at the same speed they are being blown backwards. Wind-hoverers, including the familiar kestrel, are often seen along highways.

Champion hoverers are the hummingbirds. These tiny bundles of energy are the most accomplished of all fliers. Powered by high-energy flower nectar, using muscles that are one-third their total weight and beating their wings up to 80 times each second, they not only hover, but fly vertically, sideways — even backwards. Hummingbirds have flexible wing bones and rotate their wings in a figure-eight for maximum lift while keeping the body stable. A species studied in a lab hovered continuously for almost an hour.

◀ **MASTER FLIER**
Hummingbirds, like this green-crowned brilliant, hover so that they can delicately dip their bills into flowers to sip nectar.

FLAPPING FLIGHT

Most birds flap their wings to provide power for take-off, turning and landing. Birds with relatively heavy bodies compared to their wing area — divers, ducks, geese, swans and auks — fly mainly by non-stop flapping. Starlings, swifts, swallows, crows, birds of prey, herons and cranes alternate bursts of continuous flapping with gliding. This produces an undulating flight path, as the bird flaps to gain height and speed, then loses height on the glide. Gliding saves energy, requiring only about a twentieth of that used in flapping flight.

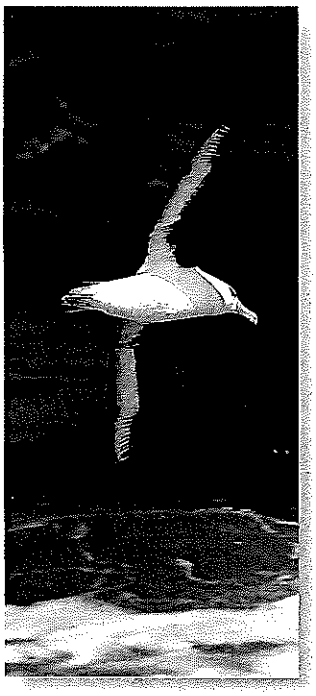
Small or medium-sized birds, such as woodpeckers, wagtails, warblers, thrushes, tits, sparrows and finches, fly with a bounding action. Instead of gliding on their short, broad wings, which produces as much drag as lift, they fold them up and briefly plummet down between flapping.

▲ **ALL A FLAP**
Ducks, like this mallard, flap almost continuously in flight.

DID YOU KNOW?

- **Albatrosses can soar for hours on end without beating their wings once, using a technique known as 'slope gliding.' They can fly around the world over oceans.**
- **Swifts may remain in the air for three years or more without ever landing**
- **Birds' bones are so light that, in some species, the feathers may weigh up to five times more than all the bones in their entire skeleton.**

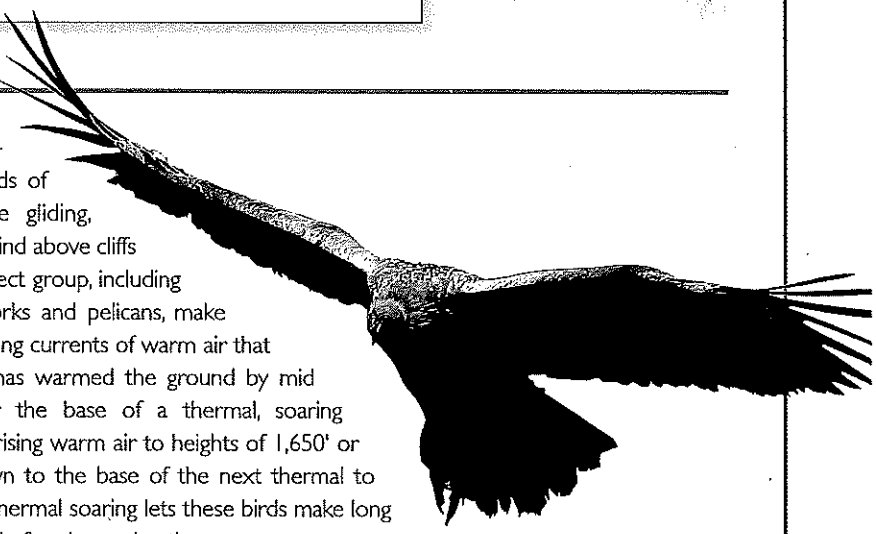
GLIDING AND SOARING



Many large birds — gulls, gannets and birds of prey — spend time gliding, using updraughts of wind above cliffs or over the sea. A select group, including vultures, buzzards, storks and pelicans, make use of thermals — rising currents of warm air that occur after the sun has warmed the ground by mid morning. Birds enter the base of a thermal, soaring upwards in spirals of rising warm air to heights of 1,650' or more, then glide down to the base of the next thermal to start the next climb. Thermal soaring lets these birds make long journeys with very little flapping, saving them energy.

Albatrosses and shearwaters spend most time over windy oceans and rely on updraughts of air created by the wind blowing over the waves. They soar across the waves in long spirals, climbing into the wind to gain height, then turning to make a fast glide assisted by the wind before repeating the process.

◀ **OCEAN WANDERER**
A black-browed albatross turns into the wind to gain height then glides down until it turns again.



▲ **AERIAL PERCH**
Cape vultures ride rising currents of warm air, allowing them to remain effortlessly airborne for long periods while they look for a meal.