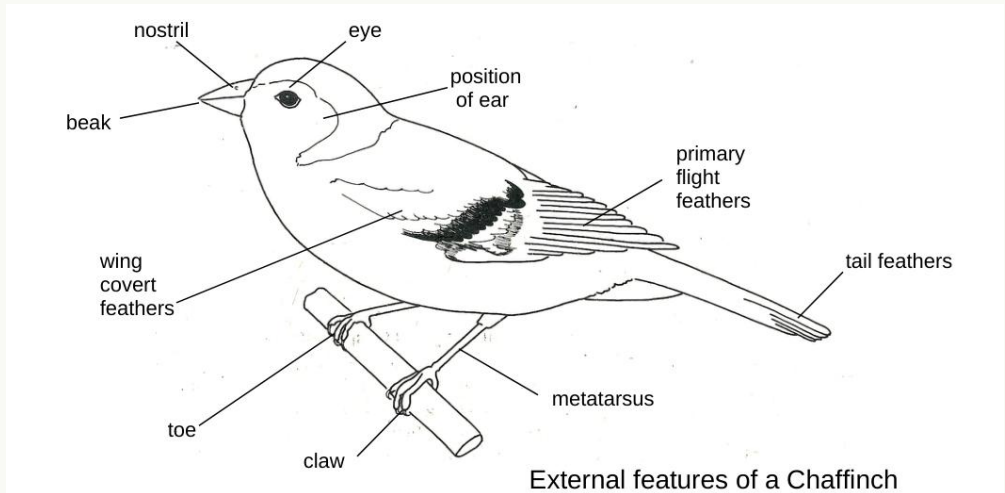


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Class Aves



Structure, natural history, and major orders

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What makes a bird a bird?

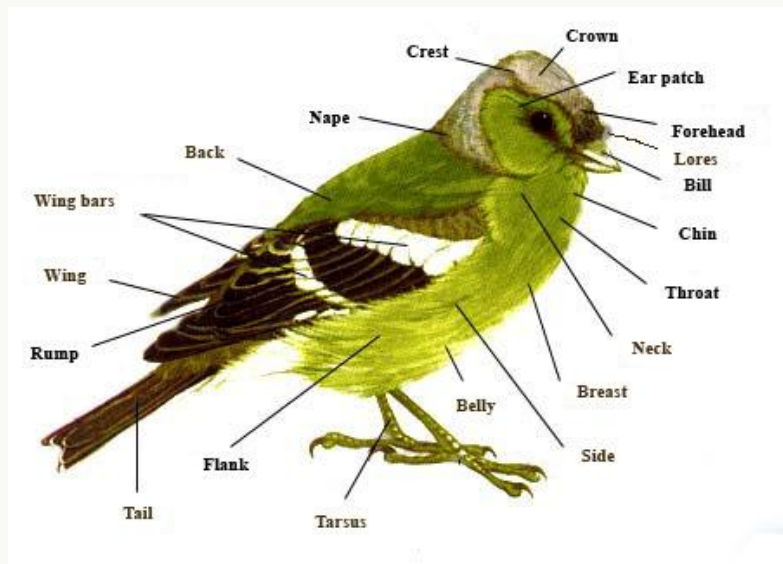
Vertebrates with feathers and beaks.

Endotherms: body heat comes mainly from metabolism.

Four-chambered heart; lungs supplied by air sacs.

All living birds lay eggs. Wings are modified forelimbs.

Flight is common, but it is not universal.



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Feathers have different jobs

Flight feathers help produce lift and control movement.

Contour feathers cover the body and streamline its shape.

Down traps air close to the skin, reducing heat loss.

Colors and patterns can conceal a bird or help it display.



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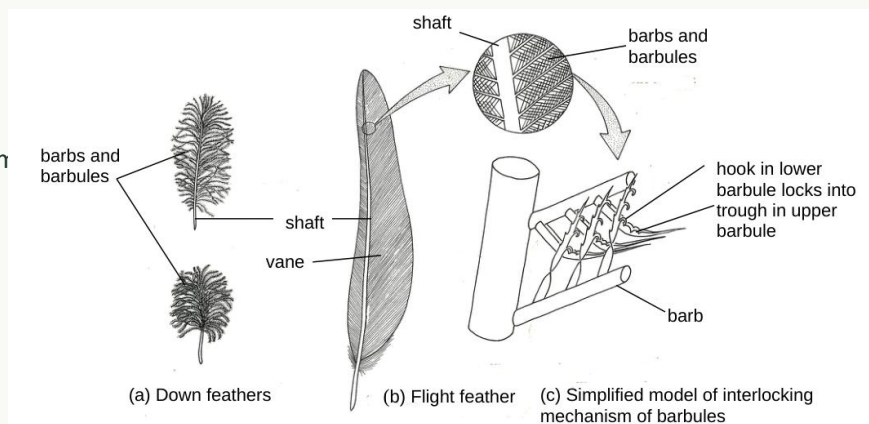
A closer look at a feather

A central shaft supports rows of barbs.

Smaller barbules branch from the barbs.

Hooklets link neighboring barbules in a firm vane.

Preening realigns feathers; molting replaces worn ones.



Feather structure • D. G. Mackean

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A strong framework for flight

Fused bones stabilize the trunk and pelvis.

A large keel anchors flight muscles in many birds.

Many bones contain air spaces with internal supports.

Not every bird bone is hollow; diving birds may have denser bones.



The keel anchors powerful flight muscles

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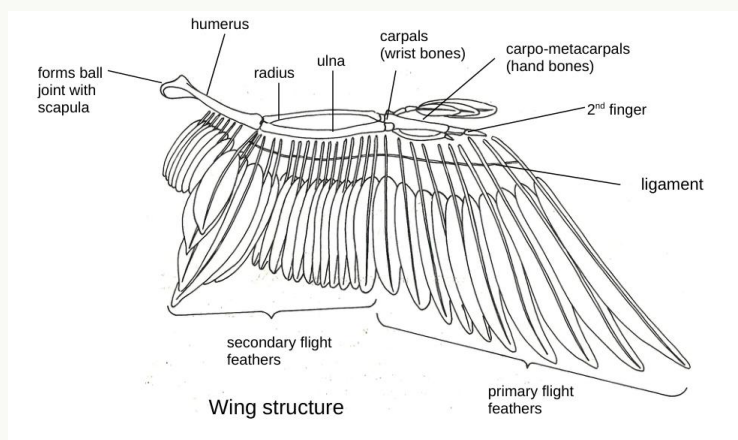
The wing is a modified forelimb

The humerus, radius, and ulna are also found in other vertebrate forelimbs.

Hand and finger bones are reduced or fused.

Primary feathers attach to the hand region.

Secondary feathers attach along the forearm.



Wing structure • D. G. Maclean

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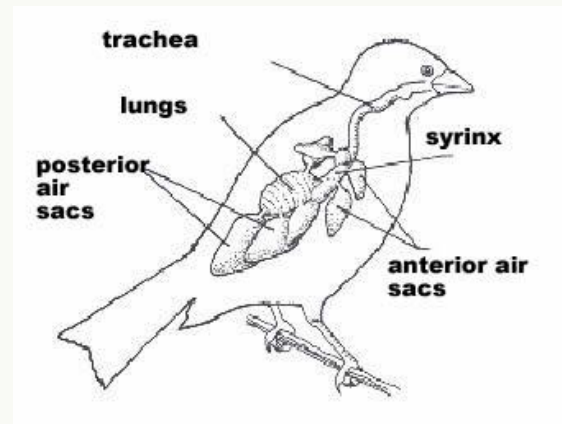
Breathing supports an active life

Air sacs move air through the lungs.

Air flows mainly one way through the gas-exchange passages.

Gas exchange occurs in the lungs, not the air sacs.

The heart separates oxygen-rich and oxygen-poor blood.



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Food moves through specialized organs

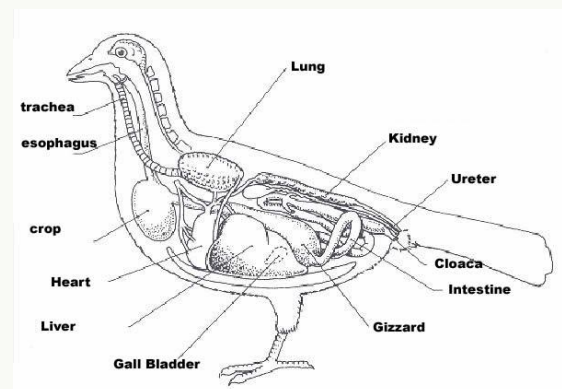
Esophagus: carries swallowed food.

Crop: stores food in birds that have one.

Glandular stomach: begins chemical digestion.

Gizzard: muscular grinding chamber.

Intestine absorbs nutrients; the cloaca is a shared exit chamber.



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A beak offers clues about food

Seed eaters often have strong, crushing bills.

Hawks and eagles tear food with hooked bills.

Woodpeckers probe and excavate for food.

Ducks and flamingos strain small food items from water.

BIRD BEAKS



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Feet offer clues about habitat

Webbed feet help ducks swim.

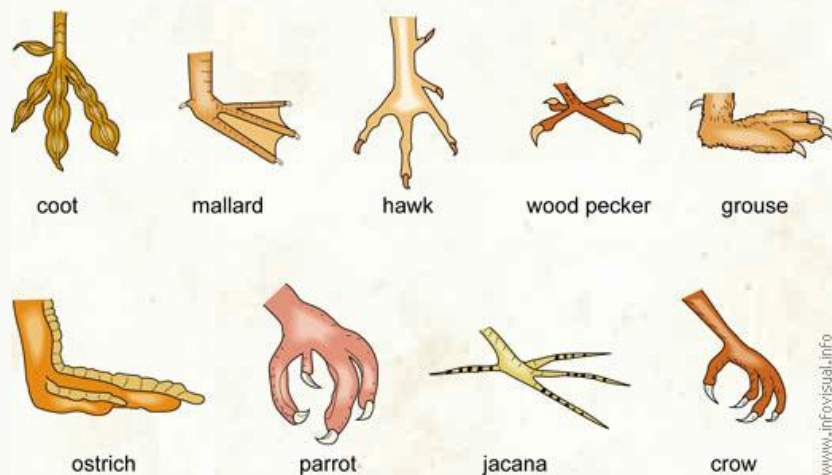
Sharp talons help raptors grasp prey.

Woodpecker toes grip tree trunks.

Long jacana toes spread weight on floating vegetation.

Ostrich legs and toes support fast running.

BIRD FEET



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Natural history: where birds live

Birds occupy forests, grasslands, deserts, wetlands, coasts, and open ocean.

A habitat must provide food, shelter, and places to reproduce.

Some species specialize; others thrive in many settings.

A bird's niche includes what it eats, where it feeds, and how it interacts with other organisms.

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Natural history: a bird's year

Breeding seasons often match periods of abundant food.

Many birds migrate between breeding and nonbreeding areas.

Other birds remain in the same region year-round.

Migration requires fuel and safe stopover habitats.

Molting replaces worn feathers; its timing varies among species.

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Eggs, nests, and growing chicks

Internal fertilization occurs before a shelled egg is laid.

Incubation keeps developing embryos at suitable temperatures.

Altricial chicks hatch helpless and need extensive care.

Precocial chicks hatch more developed and move about sooner.

Parental care and nest type vary widely.

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Behavior and ecological roles

Calls, songs, and displays communicate with other birds.

Birds may defend territories or gather in flocks.

They consume insects, pollinate flowers, disperse seeds, and scavenge.

Birds are also prey in food webs.

Habitat loss, collisions, pollution, and introduced predators can reduce populations.

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Familiar land-bird orders

Order	Common group	Examples
Passeriformes	Perching birds	Sparrows, crows, finches
Psittaciformes	Parrots	Macaws, cockatoos
Piciformes	Woodpeckers and relatives	Woodpeckers, toucans
Coraciiformes	Kingfishers and relatives	Kingfishers, bee-eaters

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Hunters and night fliers

Order	Common group	Examples
Accipitriformes	Hawks and relatives	Hawks, eagles, osprey
Falconiformes	Falcons	Peregrine falcon, kestrels
Strigiformes	Owls	Barn owl, great horned owl
Caprimulgiformes	Nightjars	Nighthawks, whip-poor-wills

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Waterfowl, shorebirds, and waders

Order	Common group	Examples
Anseriformes	Waterfowl	Ducks, geese, swans
Charadriiformes	Shorebirds and relatives	Sandpipers, gulls, avocets
Pelecaniformes	Pelicans and relatives	Pelicans, herons, spoonbills
Gruiformes	Cranes and rails	Cranes, coots, rails

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Ocean and wetland specialists

Order	Common group	Examples
Sphenisciformes	Penguins	Emperor penguin
Procellariiformes	Tube-nosed seabirds	Albatrosses, petrels
Suliformes	Boobies and relatives	Boobies, cormorants
Phoenicopteriformes	Flamingos	American flamingo
Gaviiformes	Loons	Common loon

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Ground birds and aerial specialists

Order	Common group	Examples
Galliformes	Gamebirds	Chickens, turkeys, grouse
Columbiformes	Pigeons and doves	Rock pigeon, mourning dove
Cuculiformes	Cuckoos and relatives	Cuckoos, roadrunners
Apodiformes	Swifts and hummingbirds	Chimney swift, Anna's hummingbird

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Flightless birds in several orders

Order	Common group	Examples
Struthioniformes	Ostriches	Common ostrich
Rheiformes	Rheas	Greater rhea
Casuariiformes	Cassowaries and emu	Southern cassowary, emu
Apterygiformes	Kiwis	Brown kiwis

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12A review: connect structure and life

How do down feathers and flight feathers differ?

How do the skeleton, lungs, and heart support activity?

What might a bird's beak and feet reveal about its niche?

How do migration and nesting fit into a bird's year?

Name three bird orders and give an example of each.

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Sources and teaching materials

Original lesson: life_pps_26(2).pps and life_ws_26.pdf.

Additional diagrams: Birds-1.doc and Birds-2.doc, credited to D. G. Mackean.

Bird classification: IOC World Bird List.

Feathers and migration: Cornell Lab of Ornithology.

Specific references and teaching notes are included in slide notes.

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