



# Feathered Friends

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Beaks, feathers and nests





Birds are warm blooded animals that have wings, feathers, beaks and flight.

Feathers serve several purposes: flight, insulation, defense, display, camouflage, and waterproofing. Feathers are composed of several parts: quill (calamus hollow part that connects to the skin or bone), shaft (rachis or part that holds the vane), vane or plumed part composed of barbs which in turn are composed of barbules, and the downy afterfeather used for warmth. Each barb is like a tiny feather made up of barbules with a smooth side and a hooked—barbicels—side. The barbicels are tiny hooks that hook up with nearby barbules to create a smooth vane.

# Feather terms

The calamus is the quill, the hollow lower part of a feather, without barbs, that attaches to the skin or bone.

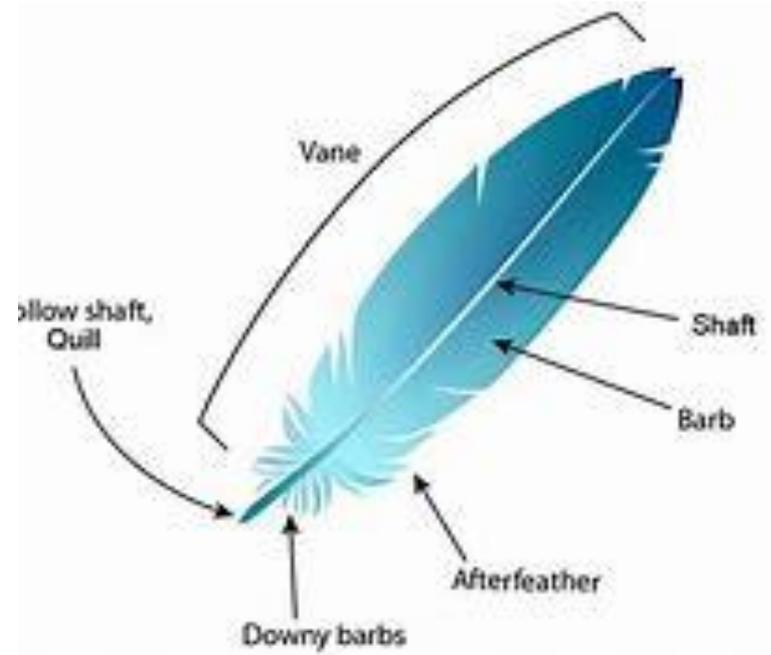
The rachis is the central part of the feather from which the barbs extend.

Barbs are parallel fibers coming off the rachis at a 45-degree angle. All the together form the vane of the feather. Barbs branch into barbules, which in turn branch into barbicels. These hook together to form the surface.

A plumulaceous microstructure has flexible barbs and relatively long barbules that trap air close to the bird's warm body.

Pennaceous feathers are stiff and flat, with microscopic hooks on the barbules interlocking to form a wind and waterproof barrier that allows birds to fly and stay dry.

Contour feathers on the wing, are called coverts. They shape it into an efficient airfoil by smoothing over the region where the flight feathers attach to the bone.



# Kinds of feathers:

Wing feathers or remiges are specialized for flight and are characterized by uniform windproof surfaces, or vanes, on either side of the central shaft that are created by an interlocking microstructure.

Tail feathers or rectrices feature an interlocking microstructure like wing feathers. These feathers support precision steering in flight.

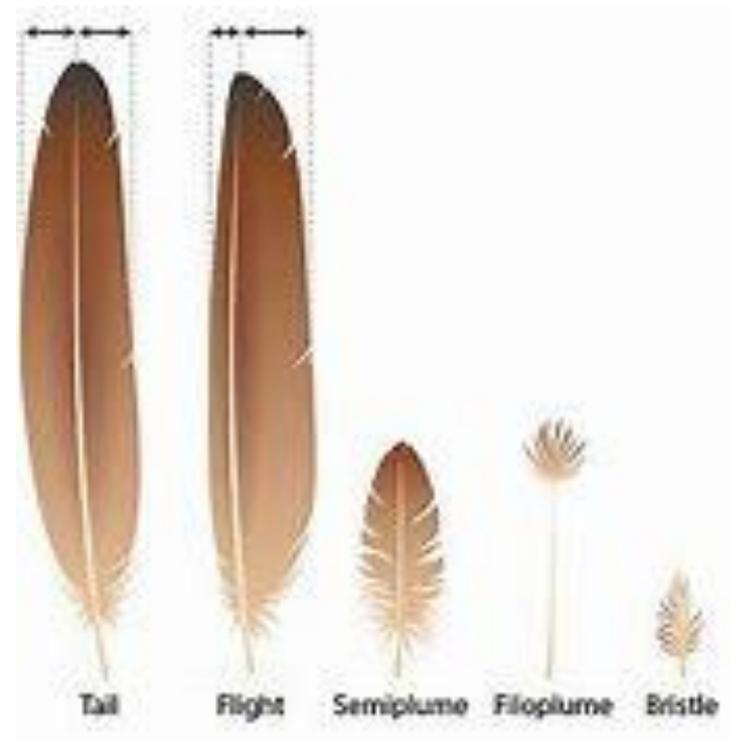
Contour feathers are what you see covering the bird's body and streamlining its shape. They are arranged in an overlapping pattern like shingles with the waterproof tips exposed to the elements and the fluffy bases tucked close to the body. They may provide camouflage or display functions.

Semiplumes are hidden beneath other feathers on the body, with a developed central rachis but no hooks on the barbules, creating a fluffy insulating structure.

Down feathers have an even looser branching structure with little or no central rachis; they are relatively short and positioned closest to the body where they trap body heat.

Filoplumes are short simple feathers with few barbs, and function like mammal whiskers to sense the position of the contour feathers.

Bristles are the simplest feathers, with a stiff rachis that usually lacks barb branches, commonly found on the head, protecting the bird's eyes and face.



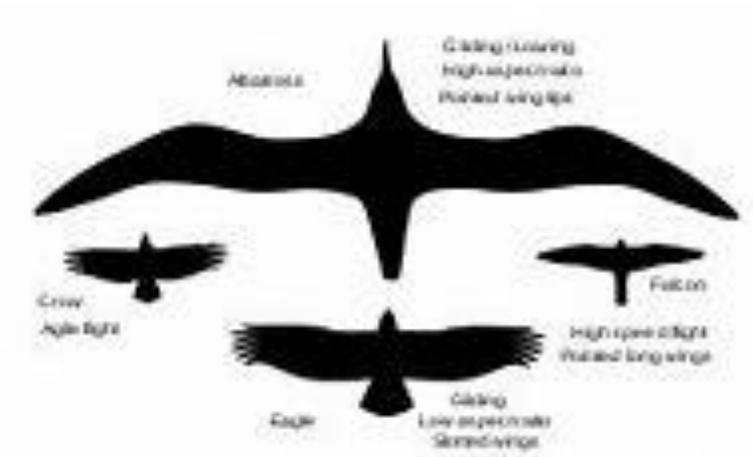
# Wing forms

Passive soaring wings have long spread-out primary feathers, creating areas that allow the bird to catch vertical columns of hot air—thermals—and rise higher in the air.

Long and narrow active soaring wings allow birds to soar, without flapping their wings, for a long time. These birds are more dependent on wind currents than passive soaring birds.

Long and thin high-speed wings are not as long as active soaring wings. Birds with this wing type are incredibly fast and can maintain their speed for a while.

Hovering wings are small and quick with nerves and muscles specially adapted for incredibly fast movement.



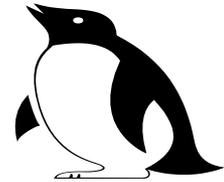
# Bird feathers and wings

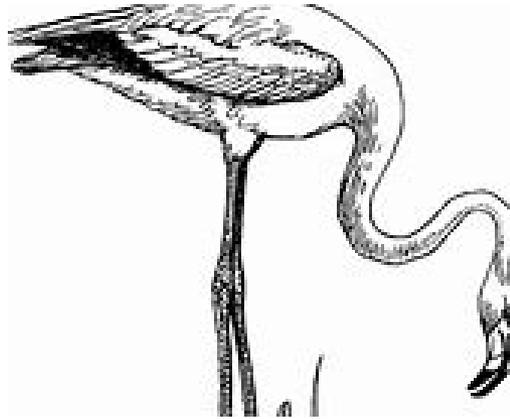
- Feathers
  - Feathers have independent roles but also work together.
  - All feathers are made up of branching structures composed of beta-keratin
  - 7 kinds: wing, tail, contour, down, semiplumes, filoplumes, bristles
  - Primary and secondary wing feathers are the most important for flight. They are anchored to bone.
  - Molting allows birds to discard old feathers and grow new ones.
- Wings
  - Remiges are large flight feathers to support the bird in flight.
  - Primaries are the longest and narrowest flight feathers attached to the “hand”.
  - Secondaries are the flight feathers attached to the forearm.
  - Scapulars cover the birds shoulder blades.
  - Coverts are a layer on non-flight feathers that provide a smooth surface to the wing.

Birds move in different ways to find food, depending on the kind of food they eat.

You can learn to “fly” like different birds:

- Swim like a penguin right angle arms
- Arms out in a V like a vulture
- Arms straight out like an eagle
- Rollercoaster up and down like a woodpecker
- Back and forth like a hummingbird
- Stand on you toes like a flamingo
- Dive with elbows up like an osprey
- Do the rooster dance  
stepstepstep stepstepstep  
shake your bottom
- Turn around like a pigeon





Bird beaks are adapted for different foods and conditions: long and hollow for nectar, long and pointed to find food in mud, cone shaped to crack seeds and shells, pouch to scoop fish, strainer to filter tiny plants and animals, gaping to trap insects, sharp pointed to pick insects from bark, long thick to pick fruit, strong sharp and pointed to chisel bark, and long to hunt for fish in water.

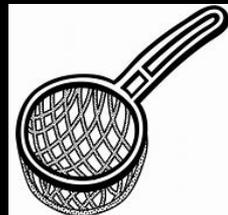


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Bird Beak Functions—bird beaks are adapted for gathering and eating different kinds of foods. What things can you find around the house that are like different kinds of beaks? Try out the things you find with beans, rice, seeds, pieces of cotton or paper and discover which “beak” works with which food,

- Long and hollow for nectar
- Long and pointed to find food in mud
- Cone shaped to crack seeds and shells
- Pouch to scoop fish
- Strainer to filter tiny plants and animals
- Gaping to trap insects
- Sharp pointed to pick insects from bark
- Long thick to pick fruit
- Strong sharp and pointed to chisel bark
- Long to hunt for fish in water



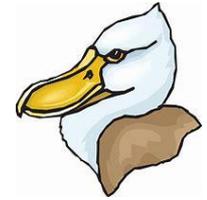


# You can be finger birds!

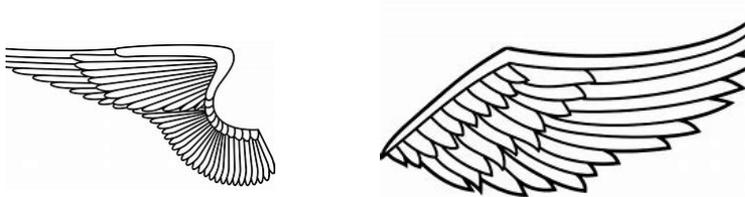
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- **Some birds flap wings  
(flap arms to sides)**
- **And some dive down--  
(dive)**
- **Some back and forth,  
(move back and forth)**
- **Some turn around! (turn  
around)**

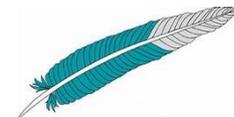
# Birdie Pokey (Hokey Pokey)



- *You put your right wing (arm) in.  
You put your left wing (arm) out.  
You put your right wing (arm) in,  
And you shake it all about.  
You do the birdie pokey  
And you turn your self around.  
That's what it's all about.*



- *You put your beak (head) in.  
You put your beak (head) out.  
You put your tail feathers (bottom) in,  
And you shake it all about.  
You do the birdie pokey  
And you turn your self around.  
That's what it's all about*



# Bird Song

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Bird beaks vary (touching mouth)

for their feeding. (hand to mouth eating)

Movements vary many ways. (hands flapping at sides)

So they're getting (bringing hands to chest)

what they're needing (patting chest)

To survive for all their days! (clapping)

Sing to *Oh My Darling Clementine*



# Bird Architects

- Bald eagles make long lasting nests adding to them each year.
- Hummingbirds make small nests which stretch as the babies grow.
- Orioles make long elaborate nests dangling from trees.
- Birds that nest on beaches make a shallow depression to use as a nest.
- Birds that nest on rocky cliffside ledges on a coast lay pointy eggs that won't roll off the edge.
- Water birds like ducks build nests floating on the water, or in grassy areas in or near the water.
- Burrowing owls build nests underground.
- Other owls are cavity nesters building nests in holes in trees and snags (dead trees).



Bird  
intelligence---  
no they're  
not  
“birdbrains”!

Bird brains, like ours are descended from reptile-like ancestors and have the same basic plan, but there are some differences:

- Bird brains are smoother.
- They have less mass , but they have big brains in relationship to head size.
- The neurons are more densely packed.
- And the proportion of neurons in the forebrain is higher.
- Crows and parrots are as intelligent as great apes, dolphins and whales!

# Bird builds

Furcula—"Wishbone" formed from 2 clavicles

Carina or Keel—extension of the breastbone anchoring the major wing muscles

Uncinate process—Extension of the ribs providing more stability to the frame

Alula—"Thumb" which helps with steering

Pygostyle—Fusion of tail vertebrae supporting tail feathers and muscles

Scleral bone—Eye bones supporting large eyes



# Weathering the weather

## Adaptations for heat and cold

### Heat

Birds adjust respiration (gular flutter) and blood flow on exposed skin, fluff up feathers to catch the wind, bathe and swim, urohidrosis (urinating on their legs), and seeking shade, water or higher elevations.

### Cold

Some birds migrate to warmer locations in the winter and return to cooler locations in the summer. Others grow extra downy feathers for insulation. The oil coating on feathers provides waterproofing. Small birds may huddle together, tucking in heads and feet. And some use ptiloerection (puffing up) to trap air.

# Eggs and hatching

Parts of the egg:

Shell and shell membrane

Chalaza cord

Yolk and vitelline membrane

Germinal disc

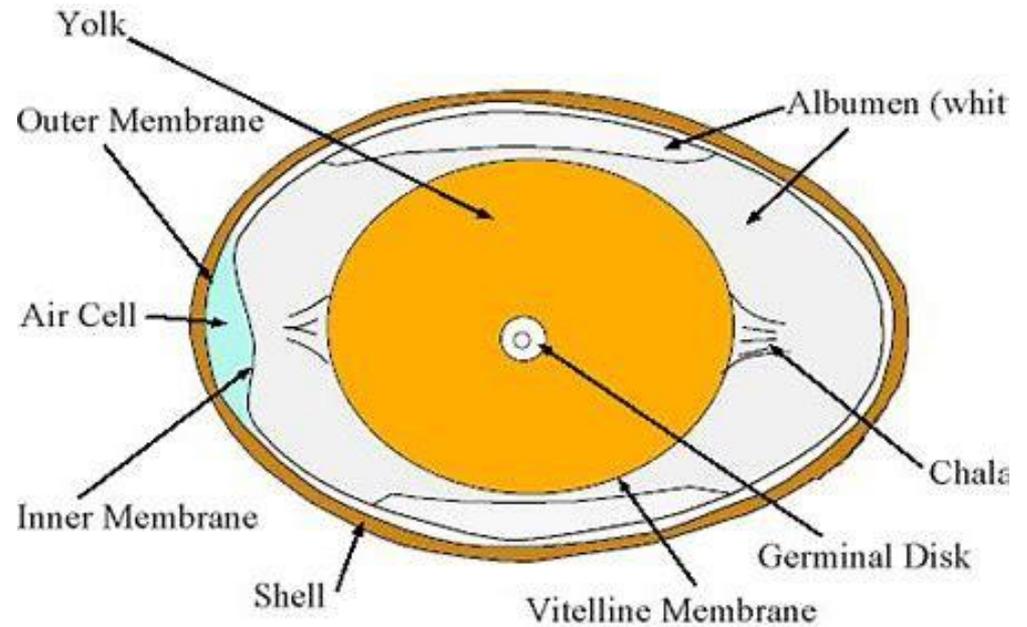
Thin and thick albumin air cell

Journey of the egg:

Ovum release > yolk/germinal spot, fertilization, albumen and membranes added, eggshell (calcium and magnesium) deposited, egg laid and incubated

Hatching:

The egg tooth and hatching muscle allow the chick to break the membrane by the air sac and crack the shell (pipping).



# Who's that? We begin to identify a bird by observing:

Size and shape in the air, on the water, on the ground, on a tree

Color numbers and location of colors; patterns of stripes, lines, spots, etc.

Behavior hunting, gathering, mating

Habitat for nesting feeding, mating

Activity, location, habits, foods, sounds



# Behavior patterns

Diurnal or nocturnal?

Most birds are diurnal. Some raptors are nocturnal, especially owls.

Solitary or social?

Many birds are social, ergo “flocks” but predatory birds may be solitary. Vegetarian birds are more social than carnivores or insectivores.

Murmuration?

Murmuration is the flocking in coordinated swirling patterns, especially of starlings.

Collective names for birds:

- A wake of buzzards
- A confusion of chiffchaffs
- A chattering of choughs
- A commotion of coots
- A murder of crows
- An asylum of cuckoos
- A curfew of curlews
- A trembling of finches
- A swatting of flycatchers
- A prayer of godwits
- A crown of kingfishers
- A parcel of linnets
- A cast of merlins
- A conspiracy of ravens

# Birds of Hardberger Park

## Sky

- Vulture
- Caracara
- Hawks
- Doves

## Trees

- Woodpeckers
- Cardinals
- Blue jays
- Titmice
- Wrens
- Mockingbirds

## Ground

- Sparrows
- Roadrunners

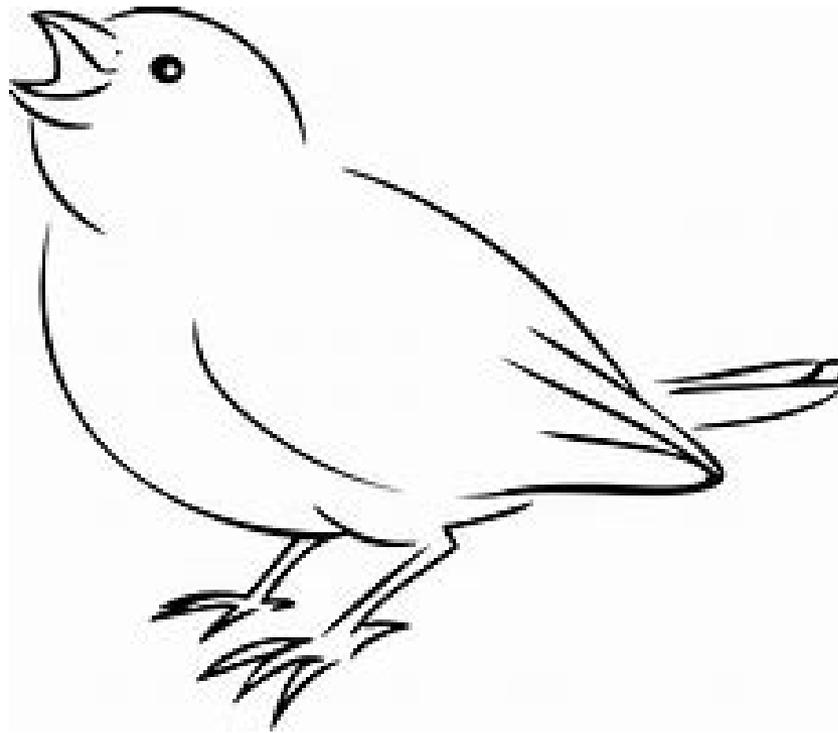
# You can take a discovery walk!

- Where is the water in your house? Where is the food? What kinds of shelter do you have? Is there space enough for each person?
- Can you find water, food and shelter for birds around your house?
- Birds can be carnivores (meat eater), herbivores (plant eater), insectivores (insect eater) or detritivores (dead animal eater). What foods do you have inside or outside your house that a carnivore or herbivore might like to eat?
- Now think of birds and beaks. What things are in your house that birds eat? What kind of beak would the birds need to eat it?
- What things are outside that a bird might like to eat? What kinds of beaks would they need to eat those foods?



You can be a bird engineer and design a bird!

You can decorate your bird and glue feathers on it.





You can  
cut out  
feathers  
for your  
bird.



You can be a bird engineer and design a bird!

You can decorate your bird and glue feathers on it.



You can be a bird engineer and design a bird!

You can decorate your bird and glue feathers on it.



You can  
imagineer  
your bird!

Or you can  
design a bird:

Feet to perch, wade or seize

Beak to crack, drill, catch, strain

Wings for long or short distances, fast or  
hovering flight

Color for camouflage, warning, attracting,  
displaying

You'll need to decide hunting and nesting  
behavior to choose how to design your bird.



....or feather collage....

Be a nature architect! What can you use to design a bird nest or bird house?

- Will you use grass, leaves and twigs?
- Will you use a box, jug, or can?





You can make bird houses, bird feeders and bird waterers from recycled materials!



# Be a nature chef!

Make a meal for a bird!  
What kind of bird are you?  
What kind of beak do you  
have? What foods do you  
have for your bird? What  
utensils will you use to eat  
those foods?



Two bird snacks...

**Bird's nest**



**Bird's food**





Here are some examples of things you can find around the house for thinking about birds!





# Bird Books

- Birds by Brian Wildsmith
- Little Green by Keith Baker
- Birds by Kevin Henkes
- Inch by Inch by Leo Lionni
- Edward the Emu by Sheena Knowles and Rod Clement



