The science in our skies

Hunting from the Skies

What are we learning?

Birds of prey are **predators.** Their bodies are **adapted** to be able to hunt their prey, this means they have special features that make them fast and powerful.

We are going to explore some of the adaptions that birds of prey have **evolved** to help them become expert hunters, for example their beaks, bones and feathers.

You will also examine different bones and then play a game to simulate trying to catch your own prey!

This worksheet accompanies our **'The Science in our Skies'** module.

To watch the videos, **sign in** to the S4 portal:

www.s4scienceportal.co.uk

And click on the 'Online Science Workshops' button!

Use the 5 words and terms below to complete the sentences about adaptation.

responds | environment | body processes | adaptions | body parts

- An _____ is a feature that makes a living organism suited to its _____. These features can be behavioural, physiological or structural.
- Behavioural adaptions effect how a species _____ to its environment.
- Physiological adaptations effect how a species' _____ are suited to its environment (for example, regulating its body temperature).
- A structural adaptation is how a species' _____ are suited to its environment (for example, having legs or fins).

What's a feather made of?

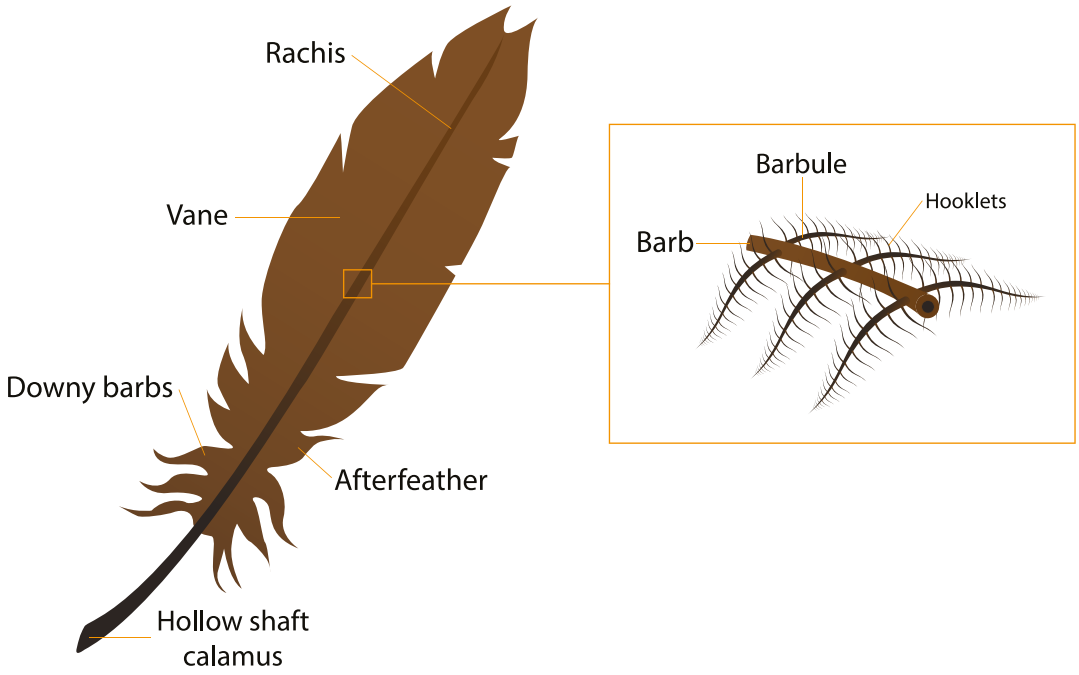
All birds have feathers. Feathers have two main purposes:

1. They help birds stay warm (insulation)
2. They help birds to fly.

The structure of a feather (how it is arranged/constructed) affects how useful they are for insulation and flight.

Feathers are made of a protein called keratin. Keratin is the same protein that our hair and fingernails are made of.

Anatomy of a bird feather



Feathers have a hollow shaft in the middle. The shaft has two parts: the **calamus** and the **rachis.**

The **calamus** is the bare portion at the bottom of the feather's shaft. It is sometimes called the quill! It is where the bird's muscles attach to the feather so that the bird can control it.

- The **rachis** is where the **vane** (the main 'frilly' bit of the feather) attaches to the central shaft.
- The **vane** is made up of branches called barbs. The bards extend outwards from the **rachis.** The barbs branch off even more into smaller **barbules.**

Types of feathers

The structure of the **barbs** and **barbules** can be different depending on where on the bird's body they are. These differences give the feathers different properties.

There are 5 main feather types:

Feather type	Structure	
Flight	These feathers are found on a bird's wings and are asymmetric (they are different on each side of the shaft). The barbules in these feathers hook together like Velcro, making the layer waterproof and strong enough for flight.	
Tail	These feathers have a similar structure to flight feathers, but they are symmetrical (they are the same on both sides of the central shaft). Tail feathers help birds to balance and steer when flying, like the tail wings on an aeroplane.	
Contour	These feathers give birds their shape and colour. They are found all over a bird's body except for on their beaks, legs and feet. At one end, towards the rachis, they have hooked barbules for rigidity (resistance to bending out of shape) and waterproofing. At the other end, close to the calamus, the barbs are more spread out which is better for insulation (keeping warm). Only the rigid tips of these feathers are coloured.	
Semi plume	These insulating feathers are found below contour feathers. The shaft is shorter and there are no hooks on the barbules, so they are very soft.	
Down	These insulating feathers have little or no shaft and are soft and fluffy for insulation.	

Activity

Investigating feathers

ACTIVITY SHEET

You will be given a feather to investigate.

Draw and label your feather.

What type of feather do you think you have? Why?

Run your hand along the feather from the tip to the calamus, making all the barbules zip together. Fan the air around you with the feather. Now, run your hand up the feather from the calamus to the tip to unzip the barbules. Fan the air around you again.

Is the feather better at moving the air when the barbules are zipped or unzipped? Why do you think this is? Which one would help the bird to fly better?

Activity

Feather adaptations in birds of prey

ACTIVITY SHEET

Draw lines to match the bird of prey to the feather adaptation!

Kestrel

Leading edge of wing feathers is serrated like a comb to allow for silent flight.

Red kite

Forked tail allows for quick twists and turns when flying.

Owl

Has stiffer wing feathers to withstand bending. Fans tail feathers and extends wing tips to allow "wind-hovering"

Bones

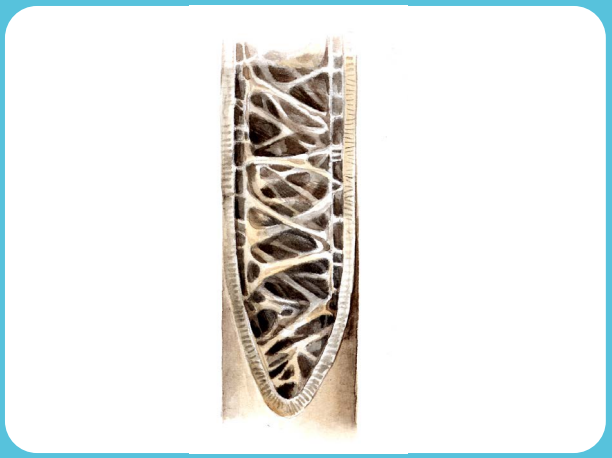
Human bones are dense, solid and heavy. This is because we need them to be strong so we can walk around on land, and to carry heavy objects.

If birds of prey had heavy bones like ours, they wouldn't be able to fly.

Birds have hollow bones. There is a lot of air in them to make them light enough to fly.

However, their bones still need to be strong enough to take off and land, so the outside is made from denser bone. There are criss-crossing fibres inside of the bone called struts. The struts provide extra strength when needed.

Fun fact



Bird bones inspired NASA's design for fuel tanks on rockets! They have a similar honeycomb structure to make them strong and light too!

Notes & doodles

Activity

Comparing bones

ACTIVITY SHEET

Here's an activity where we will compare different bones!

You will need:

- Weighing scale
- Ruler
- Selection of bones (some from birds, some from mammals)

Instructions

1. Fill in the table below and on the next page with your observations about each bone. You will need to weigh, measure and draw them. You should then decide whether you think the bone came from a mammal or a bird.

Draw the bone	Weight (g)	Length (cm)
	Width (cm)	Bird or Mammal?

Bones worksheet

It is not just the internal structure of bones that differ between birds and mammals. Birds have some bones that mammals don't. Also, some of the bones that both mammals and birds have are different shapes.

Draw the bone

Weight (g)

Length (cm)

Width (cm)

Bird or Mammal?

Draw the bone

Weight (g)

Length (cm)

Width (cm)

Bird or Mammal?

Draw the bone

Weight (g)

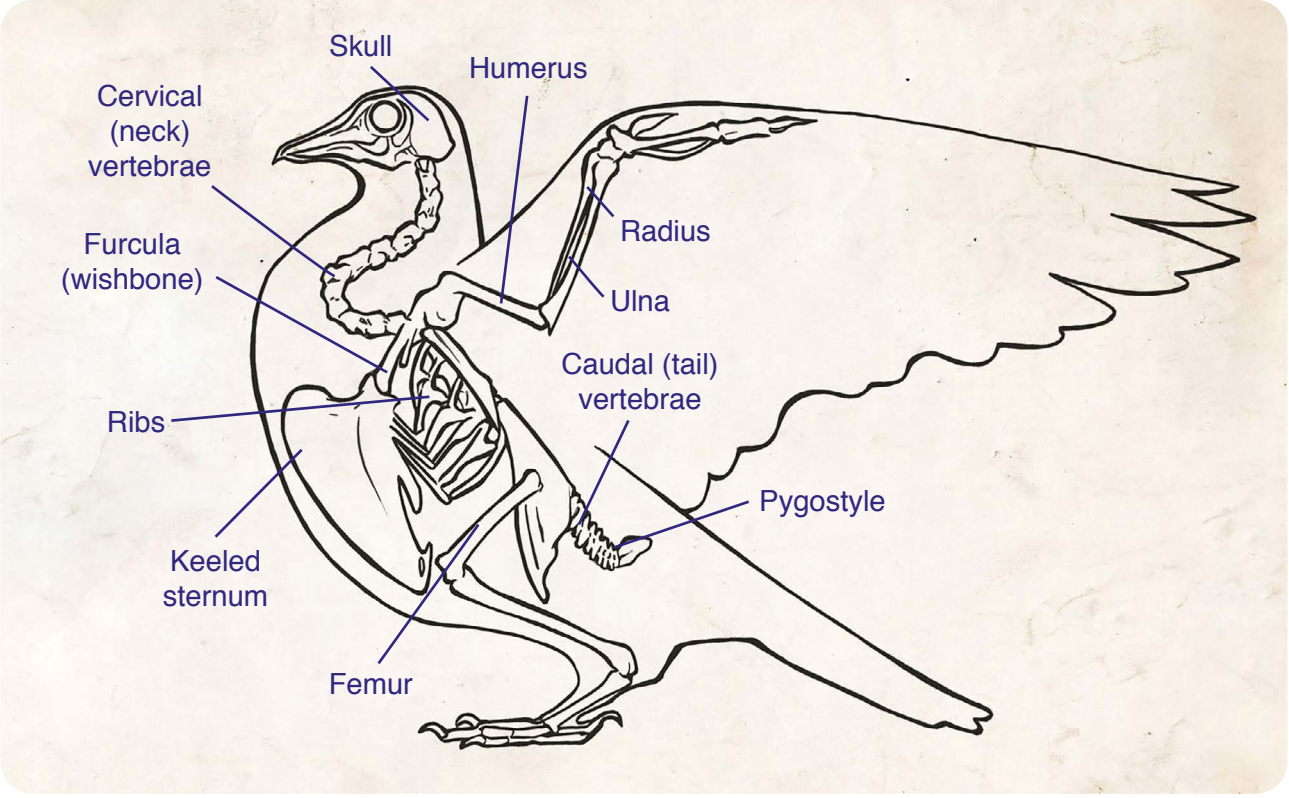
Length (cm)

Width (cm)

Bird or Mammal?

Quick Quiz

Look at the labelled diagram of the bird's skeleton and answer the questions below.



Are there any bones the bird has that you think mammals also have?

Are there any bones that you think only birds have?

One of the most obvious differences between mammal skeletons and bird skeletons is the keeled sternum. Boats have keels - the keel is underneath the boat and provides an anchor for the rest of the boats structure to keep it stable and stop it rolling. A bird's keel provides an anchor point for the strong muscles needed for flight.

Beaks

Birds don't have teeth to tear their food apart. They have beaks.

Bird beaks are often different between species, with different shapes or structures depending on what and how the bird eats. They are adapted to their diet.

Birds of prey are **carnivorous** – they eat meat – so their beaks are adapted for tearing flesh off their prey. All birds of prey have strong, curved beaks that come to a sharp point. However, there are some key differences between species depending on what they eat and how they handle their prey.

Owls have a short beak that curves downward with a hook at the end. This is to help them grasp and crush their prey, but they don't need to be able to pluck it or tear it apart because they swallow their prey whole. Their beak curves downward to protect their field of vision.

Falcons have a "tomial tooth" on their upper mandible – the top part of their beak. The tomial tooth fits into the gap between their prey's vertebrae (backbones). This allows falcons to cut their prey's spine, killing it instantly.

Owl beak

Falcon beak

Notes & doodles

Activity

Who am I?

ACTIVITY SHEET

Read the descriptions of birds of prey below and match them to their species.

Red Kite | White-tailed Sea Eagle | Gyrfalcon | Barn Owl

I have a short beak that faces downward. My serrated feathers allow me to fly silently. Who am I?

My forked tail makes me an agile flier who can turn quickly in the air. Who am I?

I kill my prey quickly once I've caught it. My tomial tooth helps with this. Who am I?

I fish for my prey. I have a strong hooked yellow beak. Who am I?

Feet

Birds of prey have powerful feet with sharp talons for killing and carrying prey. Their feet are covered in scales, with three toes facing forwards and one backwards. This allows them to grip their prey tightly.

When hunting, the birds will thrust their feet forward to catch their prey, with the feet moving faster than the rest of the bird!

Species Spotlight - Osprey

Ospreys are adapted to hunt fish. They fly about 10 to 40 metres above the water. When they have spotted a fish, they hover over the water before plunging their feet into it to grab the fish. They then take off from the water's surface, carrying the fish with them.

Fish are very slippery, so ospreys have sharp needles on the undersides of their toes and backwards-facing scales, which both help to hold the fish in place.

Ospreys also have oily feathers to stop them from getting waterlogged, which would make them too heavy to fly. Oil and water don't mix so when the osprey lands on the water, all of the water just rolls off its feathers!

Activity

Grasping prey

ACTIVITY SHEET

Explore how different adaptations make it possible for birds of prey to catch prey.

You will need:

- Prey-catching tools
  - Cocktail stick
  - Straight Tweezers smooth tip
  - Straight Tweezers ridged tip
  - Hooked tweezers
- Plastic tray of gummy bears
- Stopwatch

Instructions

1. Work in groups of 4. Each person should select a tool to be your 'feet'.
2. See how many gummy bears you can catch from the tray in 60 seconds.
3. Record your results below.

Do not eat the gummy bears – they could make you ill!

Tool used	Number of gummy bears caught
Cocktail stick	
Straight Tweezers smooth tip	
Straight Tweezers ridged tip	
Hooked tweezers	

Which tool was the best for catching gummy bears?

How do you think this relates to adaptations on birds of prey's feet?

Activity

Hunting from the skies wordsearch

ACTIVITY SHEET

Find the words below in the wordsearch.

E	V	R	S	T	U	E	S	D	M	L	M	N	E
N	P	U	E	A	A	N	U	E	B	A	R	B	S
A	A	O	L	I	R	G	O	R	E	B	M	I	D
B	R	T	U	L	S	S	R	L	E	S	T	I	O
E	F	N	B	S	E	E	O	R	U	B	L	A	N
A	W	O	R	U	N	R	V	S	A	F	U	W	T
R	R	C	A	M	A	R	I	R	T	C	O	G	I
B	P	A	B	A	V	A	N	B	A	D	H	B	T
E	E	A	E	L	B	T	R	V	O	I	R	I	R
T	T	E	U	A	I	E	A	R	O	U	T	I	S
R	M	E	G	C	I	D	C	S	M	V	O	G	S
E	U	P	P	E	R	M	A	N	D	I	B	L	E
V	R	T	I	E	A	E	S	T	H	G	I	L	F
A	R	O	S	E	M	I	P	L	U	M	E	O	T

contour | flight | barbs | serrated

upper mandible | vertebrae | tail | rachis

vane | down | calamus | barbules

Swansea University Science for Schools Scheme

Swansea University Prifysgol Abertawe

UNDEB EWROPEAIDD EUROPEAN UNION

Llywodraeth Cymru Welsh Government

Cronfa Gymdeithasol Ewrop European Social Fund

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Teacher information

Curriculum links

This worksheet is designed to complement the National Curriculum for Wales, with links provided to the former KS3 science curriculum as well as the new Science and Technology AOLE.

Key Stage 3 Science (Interdependence of organisms): 4. the interdependence of organisms and their representation as food webs, pyramids of numbers and simple energy-flow diagrams

Area of Learning and Experience: Science and Technology: *The world around us is full of living things which depend on each other for survival*

- The role of birds of prey as predators in a food web.
- The physical adaptations of birds of prey to enable them to successfully hunt their prey.
- The adaptations of birds to enable them to fly.

Equipment needed:

- Bird of prey feathers
- Bird bones – particularly skulls, leg and keel bones (break some in half to see the hollow insides) – or models
- Bones from a mammal of similar size – or models
- Various objects of different sizes, shapes and textures, and tools for trying to grab them (e.g. something pointy to pierce softer objects, something to grip around the edges, something to squeeze the object, something with a rough edge that can grab slippery objects)

Swansea University Science for Schools Scheme

Swansea University Prifysgol Abertawe

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