Conservation Education

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How Animals Move

Hop, skip, jump, run, slither, slide, glide, fly, swim, burrow, climb, soar, hover, creep, crawl, wiggle – the list of ways animals move is endless! Animals of all shapes and sizes move around in many different ways using different body parts to help them – legs, fins, flippers, wings, tails and so on.

Contents

Why do animals move?

- To find food
- To avoid being eaten
- To find shelter from the sun, wind, rain or snow
- To find each other – family members or a mate
- To find somewhere safe to rest and sleep
- To find somewhere safe to have babies and rear them successfully.

What is movement and how does it work?
Movement is when something (an animal in this case) goes from one place to another in a particular direction. It can be fast or slow, on land, in air or in water and can be done in many ways.

When animals move they ALL do two things –

1. They push backwards against something to move forwards.
2. They change shape as they move.

To push backwards they need 'propellers' of some sort, such as legs, fins or wings to push back against the ground, water or air to create the force to move them forwards.
[Try pushing one foot out behind you against the ground while you are standing up and you will find yourself moving forwards].
The force pushing forwards is equal to the force pushing back. This means the harder (and more) you push, the faster you'll move!

Bones, Skeletons and Limbs

Animals that have a skeleton inside their body with a spine (backbone) and bones are called ***vertebrates*.** They include all *mammals*, *birds*, *reptiles*, *amphibians* and *fish.*
The skeletons in vertebrates are important for movement, particularly the *limbs* (another name for legs, arms, flippers and fins).

"The arm bone's connected to the…. wrist bone…!"

Legs, arms, wings and flippers may all look very different on the outside, but if you took a look inside you'd see that the arrangement of bones is the same in all of them:

- They have 3 long bones that lead to the smaller ankle or wrist bones, then on to the fingers or toes. It may seem weird but a penguin's flipper, a whale's fin and a bird's wing all have the same bones as those in your arm!
- This is because all vertebrates are descended from the very first animals that came out of water to live on land millions of years ago. At first, the fish dragged themselves out on their fins, which gradually began to change. New bones developed and the fins gradually became legs or wings! All vertebrates have *evolved* from these early land ancestors. Over the millions of years since, different animals have developed different ways of moving around using their limbs.

What? No backbone?

Not all animals that move have bones or limbs!
Animals without a spine or internal skeleton are called the ***invertebrates*** and include minibeasts such as spiders, flies, worms, slugs, octopi, jellyfish etc. These can all move around too, even though they don't have bones to help them. More on these later…

What <u>all</u> vertebrates and invertebrates have to help them move is *muscles*, which are attached to various parts of their bodies. You have muscles in your body that help you move your limbs – look at your upper arms and see how your muscles move as you lift your lower arm up and down.

Movement on Land

Think of an animal that lives on land. Did you think of a vertebrate with four legs, perhaps an elephant, tiger or crocodile? Did you know that most of the animals on Earth are insects with six legs? Animals with four legs are actually unusual in the animal world, but they are the ones with which we are most familiar.

Four legs for walking and running:
The legs of four legged animals act like levers that push against the ground. They have *joints,* such as knees and ankles, that allow the legs to bend to make walking easier.

'Left, right, left, right!'
When they walk, 4 legged animals like horses and dogs lift one foot off the ground at a time, in sequence – the front right, then the back left, then the front left, then the back right and so on. This allows them to keep their balance as their weight shifts off one leg to the others.

- ❖ Have a go yourselves – is it easy?

As they speed up to a run or gallop, the sequence becomes far more complicated and sometimes they only have one foot on the ground; sometimes none (don't try this one!).
It is harder for an animal to keep its balance when it is running, which is why most baby mammals are very wobbly when they are first born and they have to learn to balance and walk before they can run.

The shape of an animal's body also helps it move successfully. For example, a zebra has a fairly short body compared to its long legs – this design is better for running on flat ground. A squirrel, on the other hand, has shortish legs and a relatively long body – this makes it much better at climbing trees and other steep surfaces. Squirrels can also move head first down a tree trunk – their hind feet can swivel around so they are pointing up the tree to make their claws grip better – clever, eh?


Cheetah

Speedy Gonzales!

The fastest animal on land is the cheetah – it has a very long, slim body, long, thin legs, very powerful muscles and good claws for gripping the ground. The spine is very flexible (bendy) and the cheetah can bend right up then stretch right out again to take huge strides. Its hips and shoulders are also very flexible. The cheetah's tail, which is longer than its body, is used to keep balance, especially when this big cat is turning quickly whilst chasing its prey.

Waddling Walkers

Have you ever wondered why reptiles like crocodiles and lizards appear to 'swagger' from side to side when they walk? Well, it is because their legs are attached to the sides of their bodies, which means they are permanently in the 'press-ups' position, to hold their weight off the ground, which is pretty hard work. They cannot move like this for very long. They also have an unusual sequence of leg movement– they move their right front and left back feet together, then their left front and right back feet together.

- ❖ Try this yourselves, but don't fall over!

Other animals, like foxes and horses, have their legs attached underneath their bodies, so their weight passes directly down towards the ground. This makes it easier to run fast and keep going for longer.

Two-Legged Movers

Many vertebrates find it better to move around on two legs rather than four. Humans are an example. When we walk, we place our feet down one at a time, from the heel to the ball of the foot, then, lastly, the toes. When we run, we just land on our toes to make it speedier!

Boiiiiiiiing!

In some circumstances it can be very useful to jump on two legs. For example, a kangaroo can move faster when it jumps on its long hind legs and enormous feet, using its long tail as an extra lever and balance to help.

A frog's very long back legs allow it to leap high and far – frogs land front feet first to cushion the landing.

Birds can be very fast runners on their two legs – the flightless ostrich is the fastest running bird in the world! It has very long legs to help. The roadrunner that lives in North America uses its long tail to balance and steer as it runs along at great speed.
Birds' feet help them move about too – birds that climb trees, like woodpeckers and nuthatches, have two toes pointing forwards and two back, to give them extra grip on tree trunks; while those that spend lots of time on the ground, or perched on branches, have three pointing forwards and one back (e.g. robin).

Some four-legged animals move around on both four and two legs. Some lizards, like the Bearded Lizard in Australia, sometimes get up and run on their hind legs to escape predators (and the hot ground) rather than on all fours, because it's faster.

Did you know?

- ! Kangaroos can jump 10m in one leap, at speeds of up to 25mph (40kph)
- ! Jumping spiders can jump 40 times the length of their body
- ! Fleas can leap 200 times higher than their body length (34cm)

Legless!

Even vertebrates with no legs, such as snakes, can move around very well on land:

- They have very strong muscles running down along their bodies that are attached to hundreds of ribs.
- These muscles work by lengthening down one side and shortening on the other, which makes the snake's body move side to side with a forward push.
- The scales on the snake's skin help them to grip the ground.
- If there was no roughness on the ground (e.g. like glass) snakes would slide around all over the place and not get anywhere!

You may be wondering why snakes don't have legs. Millions of years ago their ancestors did have legs. But some species probably began burrowing into the ground to live, where legs weren't much use so they slowly lost them. Even though many snakes live above ground now, the legs have never come back!

Boa constrictor

Jungle Life

Orang utan

Many vertebrates that live in the Tropical Rainforests have special legs or feet to help them move about in amongst all those trees and leaves:

- Gibbons from SE Asia swing through the trees with their long arms, hand over hand, from branch to branch. They can do this as fast as a running adult human!
- Gibbons and Orangutans have feet like hands that can grip branches too.
- Spider Monkeys and chameleons have muscley tails that can grip branches. These are called *'prehensile'* tails.
- Tree Frogs have pads on their toes that give off a sticky liquid, like glue.
- Each Gecko's foot touches down in 100 million places! They have scales and hairs on the bottom that act like suckers. If you try to pull a gecko off a sheet of glass, they grip so well the glass may break before you can get the gecko off!
- Sifakas, a type of lemur from Madagascar, have legs that are much longer than their arms. They find it easier to bounce from one leg to another while holding their arms high in the air! This looks very funny to us.
- Down by the river, the Jacana, or 'Lily Trotter', is a bird that can walk on lily leaves without sinking. Their toes are very long and spread wide, so their weight is spread over a big area. They also tread very gently!

Polar Life

Moving around on icy, snowy ground can be very tricky. How do animals manage it?

- Polar bears have very large feet to stop them sinking in the snow – their weight is spread over a wider area.
- Their feet have big, bristly pads underneath, to help them grip on the ice.
- The polar bear's large feet also make excellent paddles for swimming.
- Penguins sometimes find it easier to slide on their bellies in the snow and ice, rather than walk, if it is too slippery.

Desert Life


Namib gecko

Moving around in the desert can be tricky too. The ground can get extremely hot, or the sand can be very deep and difficult to move on. Some vertebrates have come up with some clever ways of avoiding burnt toes, or that sinking feeling!

- Camels have two big, wide 'toes' on each foot that spread their weight in the sand to stop them sinking.
- Kangaroo rats from North America have long, springy back legs, so they can leap great distances quickly in loose sand to avoid predators, or to get to the shade.
- Golden moles have big front paws and claws so they can 'swim' under the sand, where it's cooler and safer. They can dig a tunnel 4km (2.5 miles) long in one night!
- The Namib gecko has webbed feet – not for swimming but to stop it sinking in the sand.
- Sidewinder snakes throw their bodies in s-shaped loops to keep as much of their bodies off the hot ground as possible. This leaves strange tracks in the sand.
- The Bearded lizard 'dances' on two legs at a time to keep them off the hot ground. The ones in the air cool off, while the others are down on the hot sand.

Mini-movers

95% of the Earth's animals are minibeasts, many of which creep, crawl, wriggle or slither on land. They can have anything from 0 to 400 legs with a variety of methods of movement. Minibeasts don't have a spine and bones in a skeleton, like the vertebrates – some of them, like flies, have a casing (an *exoskeleton)* on the outside of their bodies; others, like worms and slugs, are soft and have no exoskeleton. All of them have muscles on their bodies to help them move. We call this group of animals the ***invertebrates***.

- Millipedes may have up to 400 legs, but they are still slow movers because their legs are only very short and their bodies long and very close to the ground. Their legs move in waves along the body, taking care not to trip up!
- Slugs and snails have one muscle called the 'foot' under their bodies, that contracts and expands to help them move forwards. The slime on their bodies helps them slide along more easily and it's sticky so they can climb up walls.
- Worms have muscles in rings around their bodies and long ones down along their bodies. They work as a team to push and pull the worm along. Bristles on the worm help grip the soil around it.
- Looping caterpillars only have legs at each end of their bodies, not in the middle, to help them grip, loop, grip, loop!
- Springtails have a sort of tight spring under their tails, that releases suddenly to help them jump – rather like a pogo stick!
- Other insects, like ants and spiders, have legs with joints that make climbing and clinging easier.


Millipede

MOVEMENT IN THE AIR

Many animals that can walk can also take off into the air. They fly, glide or float using wings, flaps of skin or even silk threads to make their way through the air. Only three types of animal can really fly.

Birds

All birds are vertebrates with wings – but not all birds can fly. Those that can't, like the ostrich, have special legs for running or walking efficiently instead.

Birds' wings are made up of the same bones as our legs and arms (see earlier), with joints to help them move and strong muscles attached to the lightweight body of the bird, so they can flap. The wings are covered in feathers, which are very lightweight and flexible and help the bird to fly. The feathers are made of *keratin* (the stuff that human hair and skin is made of), and all the feathers on the wings fit together like a fan, to make a good shape for flying.

To fly, a bird flaps its wings, which push against the air above and below, to create the force needed to move. The wings are shaped like upside-down saucers. The air pressure in the curve below is greater than the air pressure above and this creates lift off!

Different shapes of wings help birds do different things:

- **Long, thin wings, like an albatross, are good for gliding long distances.**
- **Short, rounded wings are good for 'sprinting' between trees, like a sparrow hawk.**
- **Narrow, pointed wings are good for fast flight – like a swallow.**
- **Folded back wings, like a dart shape, are a good shape for diving - for fish eating birds like gannets and kingfishers.**

Well I never…..

- **Swans have to run on the water surface flapping their wings before they can take off because they are so heavy.**
- **Hummingbirds' wings beat so fast they make a humming sound. Some humming birds can beat their wings 70 times per second! This means the bird can hover, fly forwards, backwards (the only birds in the world that can do this), side to side and even upside-down! Their wings don't flap up and down like other birds; they make a figure-of-eight shape backwards and forwards, which makes them more manoeuvrable.**
- **Baby birds cannot fly until they have grown their adult flight feathers.**

Did You Know?

! Swifts fly over 500,000km (300,000 miles) every year
! Swifts can eat, drink and sleep whilst flying
! Willow warblers fly for 96 hours without stopping
! Albatrosses can glide for 6 hours without flapping
! Mallee Fowl chicks fly the day they hatch – up into the trees for safety
! A swan can have as many as 25,216 feathers

How do birds land without crashing?

Most birds 'stall' or stop moving forwards, immediately before they touch down. They do this by holding their tails and wings out and putting their feet down first. Some birds, like the albatross, spend so much time at sea that their legs are not used to holding their body weight and they crash when they eventually come in to land!

Why do geese fly in a 'V'?

Geese can fly huge distances in one go and to save energy they fly just behind the wing tips of the one in front. This is because the air coming off the wing tips rises, so the bird behind doesn't have to work as hard! This is called '*slipstreaming'.* The lead goose has to work the hardest, so they all take it in turns at the front.

Why are some birds flightless?

Many islands have flightless birds because there are no foxes or rats (*predators*) that might eat the birds, their young, or their eggs, so they don't need to fly and escape to safety.

Furry Fliers

Bats are the only mammals that can truly fly. There are approximately 1000 species of bats on Earth. Bats' wings are very different from birds' wings. They are membranes of skin stretched between the front and back legs, rather like an umbrella. Bats are just like mice that have developed wings and can now fly! Bats beat their wings up and down like birds and can reach speeds of up to 56kph (35mph).

Did You Know?

A fruit bat has a 2m wing span

Fruit bats

Phony Fliers

Some animals are called 'flying' but they can't actually fly properly. Flying Squirrels have skin between their front and back legs and they glide between trees, a bit like using a parachute.
Paradise tree snakes are excellent gliders, but they don't have skin flaps – they hollow out their lower body to form a kind of parachute and wiggle their tail like a rudder.
Flying fish appear to fly above water to escape predators below. What they are actually doing is wagging their tails really fast just in the water and using their front fins like wings to move through the air.

Humming bird

Mini fliers

Several types of minibeasts have wings and can fly. Some of these have two wings (flies) and some have four (e.g. bees, butterflies).

- Bees and wasps hook their front and back wings together
- Butterflies have four wings but fly as if they only have two
- Dragonflies also have four wings but they can move each wing independently. This means they can dart backwards and forwards very fast and to stop suddenly.
- The front pair of wings on beetles is a horny shield that protects the delicate back wings, which they use for flying.
- Insect wings are kept strong by blood in the veins.
- Ants only have wings for a short time – when they are fully-grown and ready to find a mate. After mating they lose their wings; sometimes they chew them off!

Other minibeasts can move through the air without actually flying. Spiders, for example, can't fly (phew!) but baby ones often use silk 'parachutes' to float on the breeze to find new places to live.

Did You Know?

- ! Some butterflies flap their wings 100 times per second
- ! North American Monarch butterflies fly nearly 2000km (1200 miles) to Mexico for the winter.

Movement through water is harder than walking on land or flying, because water causes 'drag', which slows animals down. So animals that live in water have to be able to move smoothly through it and be able to control their depth, so they don't sink to the very bottom or stay right near the surface. They also need some sort of mechanism for moving forwards.

Movement Through Water

It's a fishy business….

We all know fish can swim, but how do they do it?

Rather than legs or wings, fish have fins and a tail to push against the water to make them move forwards, to steer and brake. Fins also prevent the fish from rolling over and swinging from side to side too much. Fish have strong muscles to control the fins and a good, *streamlined* shape, which is smooth and pointed, like a mini torpedo.

- To control their depth, fish have a '*swim bladder*' with air in, which they can fill to float up and let out to sink down.
- If sharks stop swimming they sink!
- Rays, which are rather like flattened sharks, have huge fins that look more like wings and they appear to 'fly' underwater.

Not just fish…..

Many other kinds of animals are good swimmers too.

- Dolphins and whales (which are mammals) have flippers and tails much like fish, except their tails are flattened horizontally and swish up and down, whereas fishes' tails are vertical and swish side to side.
- Dolphins leap out of the water for several reasons. Firstly, they cannot breathe underwater, so they have to come to the surface for air. It is also easier to move through air than water, so they can save energy if they leap out every now and then.
- Squid and octopuses squirt water out of a siphon (tube) at their rear end to move forward – at speeds up to 135kph (85mph)! To change direction they simply squirt another way.
- Turtles have flippers, which they use for swimming and dragging themselves around on sand. In water, their front flippers are for moving forwards and their back flippers are for steering.
- Some birds are excellent underwater swimmers, like the flightless penguins. They use their wings as flippers for swimming and they leap out of water like dolphins to help them go faster. They often pop out of the water onto the ice like a cork – this means they can land feet first and escape predators quickly.
- Other birds swim well on the surface, like ducks. They have webbed feet, like divers' flippers, to help them paddle against the water.
- Snakes can be excellent swimmers – they wriggle from side to side and often have flattened sides that act like paddles.

Did You Know?

! The Blue Marlin fish swims 10 times faster than the human Olympic swimming champion.
! A flying squid can jet propel itself out of water onto a ship's deck – eek!
! Mud skipper fish can walk on land using their tough front fins like crutches.
! The seahorse is the only type of fish with a *prehensile* tail, so it can grip weed and anchor itself.

Mini swimmers

Many small invertebrates live in water, and several of them are *larvae* or *pupae* (young) of adults. They have a variety of ways of moving around underwater- here are some examples:

- Water boatmen have an extra long pair of legs that they use like oars for 'rowing'.
- Dragonfly nymphs squirt water from their rear ends for jet propulsion.
- Limpets cling to rocks with a strong 'foot', which acts like a sucker. When the tide is in and they are underwater, they move around on the rocks like snails.
- Starfish (not fish at all, but a type of invertebrate) have thousands of tiny tube feet on each of their five arms. Each tube is like a small balloon filled with seawater, ending in a sucker. The feet get longer as more water goes in, which makes the suckers grip, and shorter when there's less water in them, which means the suckers can let go.

Walking on water?

Pond Skaters really can walk on water. They spread their long thin legs wide over the water surface to spread their weight. The water surface is a bit like custard skin, so the pond skater's legs don't fall through.

Animal Movers: World Record Breakers!

Peregrine falcon

- The fastest creature on the planet is a Peregrine falcon – it can reach speeds of 350kph (217mph) in a *stoop* (dive).
- The fastest bird flying in a straight line is the swift – more than 160kph (100mph)!
- The fastest animal on land is the cheetah, which can run at 96kph (60mph) flat out (but not for long)
- The fastest snake was recorded slithering at 10kph (6mph)
- The fastest lizard was running at 26kph (16mph)
- The fastest creature in water is the Sailfish – it can swim up to 107kph (67mph)!
- The fastest mammal in the sea is the Orca (Killer Whale) – 55kph (34mph)
- The deepest diving penguin is the Emperor Penguin – one was recorded diving to a depth of 260m and it was underwater for 18 minutes.
- The fastest running bird is the Ostrich (100m in 5 seconds)
- The fastest snail (not many have been tested!) was the garden snail at a whopping 0.05kph (0.03mph)!
- The slowest animal is thought to be the mole – it would take 8 hours to travel 100m.
- The slowest flying bird ever recorded was a swift – it was only traveling 19kph (12mph) whilst feeding
- The lightest flying bird is the Ruby-throated Hummingbird, which weighs just 4g
- The heaviest flying bird is the Kori Bustard from Africa – they can weigh up to 14kg – they only fly short distances in emergencies!

Mole

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