DOWNLOAD PDF HOW DO ANIMALS USE THEIR WINGS?

Chapter 1 : The nature of flight. The molecules and mechanics of flight in animals

Unlike most air vehicles, in which the objects that generate lift (wings) and thrust (engine/propeller) are separate and the wings remained fixed, flying animals use their wings to generate both lift and thrust by moving them relative to the body.

Strange animal movements Why do animals move? A good way to understand why animals move is to ask yourself the same question. Think about all the things you do in a day. You sleep, wash, eat, go to school or do anything you want to for fun. We humans, however, have some advantages like opposable thumbs which means we can hold on to things, like climbing a rock or riding a bike. To find food To protect themselves from other animals To protect themselves from the elements weather, sun, etc. To raise their young To migrate to different climates Some people see animals as only acting to meet basic needs. This means, it will walk somewhere if it thinks there is food or to find a mate. But if we look at videos on Youtube, you will see lots of examples of animals doing weird and interesting movements. Does this mean animals also move for fun? Does a hamster run on a wheel for exercise? These are great questions, but unfortunately scientists can only answer with varying degrees of accuracy. If we ask a dog why it is jumping, it is very difficult to get an answer. What do animals use to move? Animals have lots of different methods for moving. To do this they need to have the right types of body. But not all animals that swim have fins and not all those who move on the ground have legs. All animals can be put into two separate categories: A vertebrate is an animal which has a spine, bones called vertebrae which form the backbone. Many animals have backbones which link to other body parts such as legs to walk, wings to fly or tails to balance. However, some creatures pretty much only have a backbone. Snakes are one such animal. When we think of animals we might think of those which we might see at an animal sanctuary: The rest are invertebrates such as: Many insects will have both legs and wings so that they can fly from place to place, but rarely will an animal only have wings. They need some other appendage part of the body to sit and move along to find food. With vertebrates, some animals have four legs so they can move on the ground more easily, whether they want to run fast or for stability. Others, like humans, are bipedal. This means they walk on two legs. Humans have arms which allow them to reach and interact with objects or to make signals to each other. Some animals have interesting body parts which are moved for different reasons. Flies, along with many other insects, have a sucker called a proboscis. This allows them to eat, although it is also how mosquitos suck blood from other animals. Peacocks have a special fan of feathers on their tails to attract a mate. Elephants have trunks which they can use to feel around in search for food, suck up water or scratch an itch. Moose have antlers for protection and monkeys have tails to climb on trees. Animals moving on land The land is a very vague term. It can mean the Arctic tundra where there is lot of snow and ice. It could mean the mountains where there are lots of rocks, or the rainforest where there is rain and trees. Different animals need to adapt to their environment. This is often for protection to they can hide from predators, keep themselves cool in the sun or to eat the specific types of vegetation in their ecosystem. In the dessert you have many types of mammals, many of which walk on all fours. The camel has a giant hump to keep water for surviving the hot sun. But camels also have wide feet which are specially adapted for walking on sand. But they are strong so they can also walk on harder surfaces. When we look at how animals move, we often see one is in response to another. Lions walk on all fours and are incredibly strong. Their muscles are huge and they have giant jaws which can snap their prey in half. Wildebeest are almost as fast, but they have long spindly legs. This helps them to dodge lions when being chased. While camels use their wide feet to move along the sand without sinking, snakes do the same without having any feet at all. They slither by moving their bodies in a wriggle motion, similar to earthworms. Sidewinders are a special type of snake which move side to side very fast to move across the loose sand. This is a type of movement called peristalsis, the same movement we use to make food move through our digestive system. Some animals move not just on the land, but above it. They often use their paws to grab, but can use their tails also. This is not just for balance, but also to wrap around the branches. They do, however, jump from tree to tree and use flaps of skin to glide from one branch to another. Some animals, like kangaroos and wallabies , have very strong legs which allow them to jump or hop to where they are going. Much smaller animals, like a jumping spider, can also jump from place to place. Like Buzz Lightyear, they are merely falling with style. Some animals, however, do spend a lot of time in the air. While many animals on land will always stat there, animals who move in the air need to rest at some points to eat or sleep. The most obvious of animals which move in the air are possibly birds. They have wings which stretch out so they can catch air underneath. They use feathers to keep them in the air when they beat their wings, but also to navigate. Like a rudder on a boat, birds use their tails to guide the direction in which they want to go. Some are small like hummingbirds which can beat their wings anywhere up to 80 times per second. Larger birds like an eagle have huge wings which need to flap more slowly, but allow them to glide when they are way up in the air. It is not only birds which can fly. While some mammals can glide or jump very high, only one can actually fly: Bats have wings which stretch out and can wrap them up. Flapping them allows them to fly, but they also still use them as arms to hold onto fruit or clean themselves. One such example is the flying fish. It has fins which act like wings. It jumps out of the water and glides over it by catching air under its fins. However, if you set a flying fish on the ground, it would not be able to flap its fins and fly away. Insects were the first animals to develop the power of flight million years ago [2]. An insect will fly or not fly according to their purpose. They are also the only type of invertebrates which have developed the ability to fly. Some larger insects use direct flight which have wings with one hinge, such as dragonflies. The majority have two hinges and move their thorax differently to enable them to fly. Animals moving in water Like birds in flight, the first animal we might think of moving in water is the fish. Also like birds, they have a special body form to move through the water properly. This is usually in the form of fins. The fins allow them to move through the water easily. Fish use their muscles to move their bodies in a special movement. They flex back and forth, propelling them in the right direction, often very fast. Most fish will have fins which both help propel them through the water as well as to maintain balance, change direction and make other special movements. There are not just fish who can swim. Reptiles such as sea snakes and turtles can breather under water and swim. They do not use fins. Sea snakes wriggle their way through water as land snakes do on the ground. Turtles use flippers to propel through the water. Many animals are able to swim which you may not have thought. These include moose, elephants and even sloths. Of course there are other swimming animals which use interesting ways to move. Squid and octopuses have legs which are used to propel through the water. Jellyfish use their body in a special movement which allows them to float in particular directions, despite their often odd shape.

Chapter 2 : The Eagles Overview

Talks to young readers about animals that have wings such as birds, bats and butterflies; and how animals use wings to fly, land, and swim.

All bats have evolved to fly, but many species of birds have not. Plenty of species of ducks, geese, swans, cranes, ibises, parrots, falcons, auks, rheas, rails, grebes, cormorants and songbirds are flightless. Some, like the dodo, have gone extinct. Many others thrive, especially those who are powerful runners or skilled swimmers. The ostrich is a formidable runner, though, in terms of both speed and stamina. The bird can sprint up to 43 miles per hour and run long distance at speeds of up to 31 miles per hour. Ostriches use their wings sort of like rudders to help them steer while running, and their long legs can stride up to 16 feet in a single bound. Their powerful legs with their formidable two-clawed feet are potentially fatal weapons, too. Emus Like ostriches, emus are part of the ratite group of flightless birds. Emus are the second-largest birds on Earth, and they too are winged but land-bound. These flightless birds also feature powerful legs and can run at speeds up to 30 miles per hour. They take individual strides of up to 9 feet. Their feathers look more like shaggy fur, and their wings are only about 7 inches long. Emus are indigenous to Australia, where they are protected but largely viewed as pests because of their propensity for descending on farm crops in large numbers and feasting. Penguins Penguins are undoubtedly the most famous flightless birds outside the ratite family. Seventeen species exist around the globe, most of which look fairly similar except for some variation in size and head and neck markings. The little blue penguin is the smallest species, reaching only 1 foot tall; the emperor penguin is the largest, topping off at a little over 3 feet tall. Many live near the poles and in subarctic regions, while others make their homes around Australia and New Zealand. Kiwis Kiwis, of which there are five species, are another fairly well-known flightless bird. The kiwi is the national symbol of New Zealand.

Chapter 3 : Bat Wings | HowStuffWorks

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Besides insects and bats, no other group of animals can truly fly. The wings of birds are uniquely adapted to their way of life, from the daily search for food to yearly migrations lasting thousands of miles. Birds inherited from their ancestors wing structures that allow them to escape from predators, take advantage of more food sources, and make life less stressful. From Dinosaurs to Birds Birds are now widely accepted as having descended from a form of dinosaurs, evolving from a line of meat-eating dinosaurs called maniraptoran theropods similar to the Velociraptors. According to their fossil record, these dinosaurs evolved features, such as wishbones and thin-shelled eggs that resemble those of modern birds. The first bird was possibly Archaeopteryx, a winged creature that may have been capable of true flight. Some of the first birdlike creatures sported feathers on their legs, as well as their arms, according to a study by Dr. Feathers and Wings Before birds could take to the sky, they had to evolve feathers adapted to the mechanics of flying, and even specific flight styles. Feathers are light but remarkably strong. Remiges are the flight, or wing, feathers. The primary remiges, large wing feathers, attach to the "hand" portion of the wing. The secondary remiges attach to the forearm and help provide lift when the bird is soaring or flapping. Short, rounded wings help birds take off rapidly. Long, pointed wings provide speed. Long, narrow wings allow for gliding. Broad wings with slots let birds both soar and glide. Birds such as the Anhingas lose heat rapidly from their bodies, so by spreading their wings and turning their backs on the sun, they can absorb solar energy to heat themselves. Turkey vultures also use these spread-wing postures to raise their temperatures from lower nighttime to higher daytime levels. The force of rising columns of air called updrafts and thermals keep birds aloft. Some birds, namely seabirds such as albatrosses, spend much of their time in the air soaring. Seabirds use the updrafts created by the actions of waves to soar. Soaring birds tend to have high-aspect-ratio wings, meaning their wing lengths are much greater than their wing areas. This quality gives soaring birds their characteristic long, thin wings. Flightless Birds Although flightless birds have adapted to life below, their wings have not entirely disappeared from their anatomies. Birds evolved to fly, but some birds have lost this ability when their bodies eventually adapted to terrestrial or aquatic environments and flying became too costly, energy-wise. Penguin wings have basically changed into flippers to facilitate swimming. The flightless cormorant of the Galapagos Islands used to be able to fly, but has since lost that capacity in favor of gliding through the water. Large birds, such as ostriches and rheas, use their proportionately smaller wings in impressive displays. Migratory Birds Many birds take long flights called migrations to warmer regions of the world during the colder months. The Blackpoll warbler makes its annual trip by staying in the air for 80 to 90 hours without resting. Not all birds possess the ability to migrate, however; in addition to internal adaptations, specialized wings aid migratory birds in making their long flights. Migrating birds feature more pointed wings, which are large compared to their bodies, resulting in less laborious flying. A study published in "Current Biology" and conducted by Drs. Charles Brown and Mary Brown has found evidence of evolution occurring in the wings of cliff swallows in Nebraska. Road killed cliff swallows were found to have longer wings than many others in their populations. The scientists theorized that these swallows, nesting in highway bridges and overpasses, evolved shorter, rounder wings to be able to take off in a more vertical fashion, thereby allowing the birds to flee from oncoming vehicles.

Chapter 4 : Limb (anatomy) - Wikipedia

Presents information about how such animals as butterflies, birds, and bats use their wings. From The Community. Amazon Try Prime Books. Go Search.

The Eagle has commonly become a symbol of strength and might, but also of freedom and justice. These great birds have large, broad wings and sharp talons that they use to seize their prey of rodents, lizards , fish , and other such animals. They build nests, or eyries, in tall trees or on cliffs where they will fiercely protect their young. Most Eagles are about 70 to 90 nailsbreadths long from the tip of their bill to the end of their tail and weigh 8 to 13 ods, though some may be much bigger are far smaller. Most Eagles have a wingspan of 2 fores, but some can have wingspans far larger. Females are usually a little larger than the males, but all Eagles are exceptionally strong, sometimes able to catch and carry prey that weighs nearly as much as they do. Despite the location of these eyes, however, the Eagle can see straight ahead. Despite this, though, most Eagles fly close to the ground when hunting to better spot and catch prey. They sometimes catch their prey using their large, strong beaks which have a hook at the tip to tear prey. The beak is usually between 5 to 7 nailsbreadths in length, but can be even larger than that. Eagles have strong, broad wings that make them look clumsy when they are on the ground. Eagles can glide for incredible distances by merely holding their wings out firmly. When an Eagle flies, the wings almost appear like hands with finger-like feathers protruding from an elongated palm. The feathers tend to turn upward slightly as the Eagle flies. Despite their strength, the wings are not used to fight, though some Eagles have been seen using their wings to beat prey. Most Eagles are colored in deep browns and blacks, but many will have white areas on their body, such as their heads, their tails, their bellies, their legs, or sometimes even the tips of their wing-feathers. Baby Eagles, called Eaglets, tend to have a different feather coloration than their parents. They are typically grayish-white and are very soft. As the Eaglets mature, they will gain the feather coloration of their parent. Eagles have very strong feet and legs. The feet are typically a bright or golden yellow and scaled, while the legs are feathered in white, brown, or black. The dangerously sharp talons are used to seize and carry pray. These talon are long and curved, and come to a jet-black point. Eagles are incredibly strong creatures, capable of carrying prey that is nearly as heavy as themselves. An Eagle is very strong and quite powerful, and is very respected for its abilities. But its strength is not the only way in which this noble animal stands out among the animal kingdom. It has very keen sight, though it typically hunts low to the ground. Eagles are also fairly smart, sure to avoid danger whenever possible and usually staying out of the way of humans , elves , or other sentient beings. Eagles are found everywhere in Sarvonia and in parts of Nybelmar and other such continents. They have even been found in small numbers in Cyhalloi. It is believed that huge Eagles may live in several secluded mountaintops, but none are sure as of yet. Eagles usually live in nests, or eyries, whether or not they are currently taking care of infants or not. Eagles first build nests when they find their mate, and will commonly build the nests from sticks and branches. The Eagles are constantly adding to and refurbishing the nest, especially when Eaglets are on their way, and will also sometimes decorate their nests with fresh leaves. Because the nests are constantly being added to, they get bigger over time. A new eyrie may only be about 9 palmspans across and 4. However, old eyries may be 1 ped across and 2 peds deep. These sizes can vary tremendously, though, depending upon the species. Some Eagles prefer to build their eyries in the tops of tall trees, often oaks or some other strong tree, usually near water. Other Eagles may nest on high cliffs in the mountains. Some Eagles of Nybelmar will even build their nests on the ground. Though most Eagles only have one eyrie that they use every year for their young, some species build two: Eagles, especially at close range, look fierce and proud, and are often depicted as such, seen as strong, courageous hunters. They commonly hunt in their mating pairs, though it is more common to see an Eagle hunting alone, especially when there are eggs in the nests. Eagles mate for life, but if one mate dies, the other will usually seek out a mate and breed the next year. Eagles are very smart. They are careful to avoid fanger and are typically cautious of humans , elves , and other sentient beings, and sure make their nests away from villages and towns. However, Eagles are also fierce protectors of their nests and young, and if a person comes too close to their eyries, the Eagle may dive at them, maybe even strike with their talons. An exception to this includes the Yourth Clan of the Eyelian tribe , who are known to be able to tame these magnificent birds. Eagles hunt during the day because they spend the nights at their nests, otherwise known as eyries, or on a safe perch. Eagles eat a variety of foods depending on where they live, but rodents are a common food for all Eagles. Rabbits, hares, ground-dwelling kuatu , and even mice and rats are fed upon by these predatory birds. They sometimes eat larger animals, such as young deer or lambs, but such occurrences are very rare because of the weight of such prey. Rodents and the aforementioned larger animals are usually caught by being startling. An Eagle will fly low over a hillside and, when it sees its prey, will swoop down to quickly seize it with its sharp, strong talons Some Eagles living near oceans, rivers, and lakes will often eat fish , like whitetail, sunset fish , and especially salmon. However, Eagles cannot swim, and would drown if their wings got too wet to allow them to take off from the water. They can sometimes avoid having to dive for fish by stealing them from other birds, especially water birds, which also help them to locate where schoals of fish may be located. Eagles will also commonly eat snakes and lizards , and sometimes even other birds, like small finches, as well as dead animals they find. Some species will even eat monkeys and other such animals. Eagles mate at different seasons in different places, but early to late spring is average. When an Eagle finds a mate, the mate is kept for life. A young Eagle will typically find his mate when he is about two years old. The mating process is quick and involves the Eagles pressing their abdomens together. After a few weeks, the mother Eagle with lay 2 eggs, though rarely she will lay 3. Eagle eggs are about 8 nailsbreadths long, 5 nailsbreadths across, and may be any combination of colors depending on the species. The eggs may be white, yellow, or even speckles in colors like red, brown, or gray. Before they are bale to hatch, the eggs must be warmed for about 35 to 45 days, depending on the species. The female Eagle sits on the eggs during most of the incubation. The male will sit on them occasionally, but typically spends his time hunting and bringing food for his brooding mate. When the Eaglets hatch, their eyes are already open and they are covered with a grayish-white down. Their feathers being to grow in when they are four weeks old. Their parents both protect them and help in feeding, as they are unable to tear up their own food until they are about six to eight weeks old. Eaglets are able to leave the nests when they are 11 or 12 weeks old, but since, at this time, they are not very skilled at flying, they will stay near the nest for several weeks longer. The parents will feed them for sometimes months until they learn to hunt of their own. Within two years they will typically have a mate. Most Eagles live between 20 and 50 years. Eagles often hatch in 2 eggs, but it is unusual for both to survive. Usually one will hatch a few days before his or her sibling, and because the older chick is larger and stronger, it will dominate the nest, usually stealing away most of the food and sometimes even attacking the younger hatchling. The younger will commonly die within a few weeks. Sometimes members of the Yourth Clan will save the baby Eaglet and raise it until it is able to live on its own. The Eagles are not often kept as pets, as they tend to be wild and hard to tame. Oftentimes people will steal eggs or baby chicks from a nest, especially since one usually dies from each nest. Yourth Clan members will sometimes do this for the good of the chick, and will release it when it is able to live on its own. However, sometimes people will try to keep the Eagle. This can often be very dangerous. The Eagles have sharp and deadly talons that can rip flesh. Very few have ever been able to tame an Eagle to the point it is nearly harmless. Eagles were used during the War of the Chosen to create other creatures, probably because of the great strength and intelligence these creatures possess. The gryph and the griffon were both created using parts of the Eagle. Both creatures have the head, wings, and front feet of a majestic Eagle while having the back parts of an oracau. The symbol of the Eagle is often used to represent freedom, justice, and strength. The city of Marcogg for example uses an Eagle on its insignia, featuring a great Toran Eagle flying over a ship. Many cities have taken up the symbol of an Eagle to represent them. Voldar also uses an Eagle, or rather, the silhouette of an eagle, on its coat of arms. Eagles are known for their superb hunting abilities, and are sometimes associated with Arvins , but more people commonly think of the Eagle as being connected with Etherus. Etherus especially is often associated with Aecilian, a proud and majestic eagle that is believed to fly to heights that most birds cannot reach. Its long wingspan and rich, red color make it stand out against the sky. However, it is also tragic that these birds for seemingly no reason, crash into mountain rocks and end their lives.

Chapter 5 : All about butterflies | Department of Horticulture

An introduction to the ways in which various animals use their wings, including flying and landing.

Eggs are usually sold as a dozen. For example, a lion is a predator How Do Birds Use their Feathers? Feathers make birds unique animals. How they are used by birds can be unique too. If you think to yourself, you can probably come up with maybe a half dozen to a dozen ways feathers are used by birds. To be sure, you will have missed a few feather functions. Flying Flight feathers are very strong and stiff feathers that are found on the wings of birds. How much body heat they keep can be adjusted by arranging their feathers to trap more or less air. If you see birds fluffing their feathers in the cold, that is their way of adding extra air to trap body heat and stay warmer. The tough material they are made from, beta-keratin, is water and wear resistant. Darker-colored feathers might also provide protection from the sun. Feathers also work to keep water out, keeping birds dry in the rain. The interlocking feather barbs and a special coating that is either oily or waxy create a shield that water runs off of. Swimming and Diving Some birds use their half-spread out wings in a flying motion to swim in water. Floating Using the trapped air in downy feathers, water birds like ducks can float on water as well as add protection from cold water. Snowshoeing One of the more unusual feather uses is snowshoeing. Grouse, chicken-like birds that live in snow-covered areas, have feather-covered feet in the winter that increase the size of the foot just like snowshoes. This keeps the birds from sinking into the snow. Tobogganing Why walk if you can slide, or in the case of penguins, toboggan. The Antarctic birds flop down on the smooth feathers of their bellies and use their flipper-like wings together with their feet to move themselves, toboggan-like, across snow and ice. Bracing When not flying, many birds use their tail feathers as supports when on the ground or climbing the sides of trees such as is seen with woodpeckers. Feeling Feathers do not have nerves , but they do stimulate nerves that surround where the feather attaches to the bird. Birds can adjust the position of their feathers and posture depending on the stimulation of those nerves. Hearing Some predators, especially owls, have their face feathers arranged like two dishes facial discs to collect and channel sounds into their ears so they can more accurately locate prey in the dark parabolic reflector. You can think of them as an early stealth fighter plane. Helping to Keep a Steady Supply of Food Hummingbirds help to pollinate flowers when foraging for sweet nectar when the feathers around their heads pick up pollen from a flower. As they continue looking for more nectar, the pollen is then transferred to other flowers. Eating Special long feathers called rictal bristles are found around the mouths of some insect-eating birds. These may either act like a funnel to catch the insect in the air, or they may protect the eyes while catching an insect. Other birds use feathers on the side of their mouths to select fruits. Keeping Clean Some birds, like herons, have small feathers called powder down that they crush with their beak and feet to rub into the normal feathers and keep them conditioned. This powder down may also help control feather parasites like mites. Aiding Digestion Some fish-eating birds also eat their own feathers to line their digestive area. This helps to protect the bird from sharp fish bones. Constructing Nests Many birds especially water birds line their nests with bird feathers. This helps to keep their eggs warm and also provides a soft padding. Some birds like parakeets actually use the feathers located on their bottom and lower back to move grass and leaves to their nest. They can then use the water to keep the eggs from drying out and to give their chicks a drink. Some birds that live in the desert like the sandgrouse have special belly feathers that are very good at holding water. Escaping From Predators When birds are attacked or frightened they can drop some of their tail feathers. This is called fright molt. This sometimes helps the bird get away, leaving the attacker with only a mouth or foot full of feathers. Sending Visual Signals Feather colors and patterns are used to send signals to mates and rivals. This is likely the largest and most used function of feathers. Camouflage Sometimes bright colors are not good. To keep from being seen by predators, many birds have feathers that look like dead leaves or other parts of the surroundings they live in so that predators cannot see them. Some predators also like to blend in so that their prey may come closer, making the prey easier to catch.

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Chapter 6 : What Animals Have Wings? | Sciencing

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Macaws are king-sized members of the parrot family and have typical parrot features. Their large, strong, curved beaks are designed to crush nuts and seeds. Their strong, agile toes are used like hands to grasp things. Loud, screeching and squawking voices help make their presence known in dense rain forests. They are also famous for their bright colors, which seem bold and conspicuous to us but actually blend in well with the green leaves, red and yellow fruits, and bluish shadows of the forest homes. When they come in for a landing, they drop their tail and feet downward and use their wings like brakes to slow down before grasping a perch with their feet. Most macaws nest in holes of trees or in earthen banks and cliff sides. Macaws are intelligent and curious birds that like to explore and keep busy. They are very aware of their surroundings, which is necessary to keep watch for predators. As social birds, they spend a lot of time interacting with their mates and their family groups. Macaws have been known to use items as tools, and they like to play with interesting objects they find. They exam the objects from different angles, moving them with their feet, testing them with their tongue, and tossing them around. Macaws are also big chewers, something they need to do to keep their beaks in good shape. They can do impressive damage to even very hard wood with their beaks. Screaming is a natural call for macaws. They do it to make contact with one another, to define territory, and even as part of their play. Their calls can be quite earsplitting to humans! Macaws can also imitate sounds, and macaws that live with or near humans often repeat words they hear, practicing to themselves until they get it right. They usually wake before dawn, preening their feathers and calling to one another, perhaps communicating where they are and what they plan to do next. In fact, macaws fly as far as 15 miles 24 kilometers each day to feed. They feast until midday, when they settle down for more preening and "chatting," then forage more in the afternoon. Shortly before or after dusk, macaws all take wing again to return to their roosting site, where they call to each other to figure out who sits where. The sitting arrangement can change from day to day! Sometimes squabbles break out, but macaws rarely physically injure each other. Once everyone is settled, they quiet down, fluff out their feathers, and prepare to snooze through the night. Macaws eat a variety of ripe and unripe fruits, nuts and seeds, flowers, leaves, and stems of plants, and sources of protein like insects and snails. Some species specialize in eating the hard fruits and nuts of palm trees. One trick they use for this is to forage in fields where cattle live. This makes the nuts softer and easier for the macaws to eat! Macaws also visit riverbanks and cliffs made of clay soil, which they eat. Scientists believe the soil neutralizes any toxic chemicals the birds might eat in seeds or unripe fruits, possibly preventing stomachaches. At the San Diego Zoo and the San Diego Zoo Safari Park, the macaws are fed fruits and berries, nuts and seeds, cut-up vegetables, and special bird biscuits containing vitamins and minerals. When adult macaws choose mates, they usually stay together until one of them dies. This close relationship is called a pair bond. The bond is so strong that even when the pair flies with a large flock, the two stay close together, with their wings almost touching. Most macaw pairs breed once a year, and the female lays her eggs in a nest inside a tree hollow or in a dirt hollow on a cliff face. Only the mother does the incubating until the chicks hatch; the father is in charge of bringing food to her. Once chicks hatch, both parents bring them food. Macaw chicks are helpless at first. Many times chicks in the same nest compete for food, and most often only the older, stronger chick survives. The fledglings are clumsy at first as they learn to fly, at about three months of age, but once they get the hang of it, they start flying with the adults to forage for food. After years of experience and careful research, we realized that breeding pairs require lots of space for exercise and a natural diet for breeding success. Providing a proper nesting box was also essential, and many types were tried. We found that the macaws favored wooden barrels, as they simulated hollow trees. Today, many of the macaws in our collection serve as ambassadors, trained for animal presentations and educational programs at the San Diego Zoo and San Diego Zoo Safari Park. You can also watch macaws in flight! What a colorful and noisy experience! Unfortunately, trapping for the pet trade is a major factor in macaw population declines. Captured macaw chicks can often bring in thousands of dollars from collectors to the trappers, giving them incentive to continue this practice. Logging, farming, and development have reduced macaw habitat. Conservationists are trying different strategies for helping macaws, such as offering money to local inhabitants for leaving the birds and their habitat alone or using tourist fees to buy up and protect areas of forests where visitors can see the birds. Many reserves have been created in macaw habitat that include lodges built for tourists interested in seeing these colorful birds. The lodges provide jobs for the local people, helping them earn a living by working with the forest rather than clearing it. Some programs have even hired macaw hunters as guides, transforming them from poachers to protectors. Many organizations continue to work to help conserve macaws. From here we hope to learn more about macaws and other rain forest birds.

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Chapter 7 : Macaw | San Diego Zoo Animals & Plants

How Do Birds Use their Feathers? Feathers make birds unique animals. How they are used by birds can be unique too. If you think to yourself, you can probably come up with maybe a half dozen to a dozen ways feathers are used by birds.

This article has been corrected. This article has been cited by other articles in PMC. Since the dawn of civilization, humans have envied their feathery companions for their ability to leap from the earth, escape gravityâ€"and all earthly problemsâ€"and ascend to the skies. Of course, humans eventually made it into the skies too, albeit after a few millennia and rather inelegantly with the help of technology. Even so, we can now fly around the Earth in a matter of hours or zoom about in a fighter plane at supersonic speeds. Yet, flying has never lost its fascination for humans, and many scientists continue to study how various species have mastered the physical and metabolic challenges of flight. Many of the basic questions regarding aerodynamics and the physical mechanics of flightâ€"including the fundamental one of how the bumblebee manages to stay in the airâ€"have largely been resolved. Now, the spotlight has moved to focus on the underlying metabolic and molecular mechanisms that enable animals to fly. The ability to fly appears to have evolved separately at least four times: Although pterosaurs are extinct, the other three provide unique opportunities to study the aerodynamic and molecular features of animal flight. The evolution of flight in both vertebrates and invertebrates has led to a wide variety of adaptations to exploit unique physiological advantages and to overcome specific deficiencies. For example, size matters and, owing to various mathematical laws, smaller animals have to flap their wings faster to stay in the air. Furthermore, air resistance is a more significant problem for smaller animals, which means that there is an effective minimum size for flight. Yet other factors mean that flying animals also cannot be too large; oxygen and sugars have to travel further around the body, and the power required for take off is proportionately greaterâ€"as can be seen by watching how large birds such as swans or albatrosses struggle to get airborne. Recent research into Argentavis magnificensâ€"the largest bird ever known to have flownâ€"demonstrated that its 7 m wingspan was so great that it simply could not have taken off from the ground. The mathematical model, created by Sankar Chatterjee and co-workers, and based on fossil bones of the bird and on computer flight models, demonstrated that Argentavis must have launched from high places, using thermals and updrafts to gain height before gliding for up to miles at a time Chatterjee et al, The phenomenon of hovering flight is a good starting point from which to study how animals have adapted their bodies to be able to fly. Hovering is particularly energy-demanding and has evolved separately in birds, insects and mammals that feed on plant nectar. Although hovering does not consume energy quite as quickly as chasing prey or evading predators, it must be sustained for longer periods and therefore requires huge amounts of fuel and the ability to metabolize it efficiently. Hummingbirds are the champions of hovering and consume around five times their body weight in fuel per day. Hummingbirds are also one of the largest and most successful avian groups with known species occupying a wide variety of ecological niches in the Americas. Some have mastered hovering at altitudes of up to 5, m in the Andes, thus overcoming the twin handicaps of diminished oxygen supply and the need for even faster wing beats to stay aloft in the thin air. In fact, during the course of their evolution, hummingbirds were able to take several avian adaptations to their absolute limit. These include respiratory and metabolic functions, and altered blood chemistry. For example, the alveoli of birdsâ€"the final branches of the respiratory tree in the lungs, where oxygen and carbon dioxide are exchanged with the bloodâ€"are tubular and provide a greater surface area for gas exchange than those of mammals, which are spherical sacs. In addition, avian haemoglobin has a higher affinity for oxygen than its mammalian counterpart and birds have thinner blood, which provides less resistance to rapid circulation. The most obvious adaptations, however, are wings. Bird wings are forelimbs, but the bones of the digits are fused into a single unit called the carpometacarpus and the flying surface is made of feathers rather than skin. Apart from providing superb insulation, feathers also confer aerodynamic advantages that reduce energy consumption. Experiments in wind tunnels have shown that bird flight is actually more efficient than would be predicted based on the shape of their wings alone. Feathers obviously provide additional energy savings, perhaps by exploiting local turbulences to reduce drag and increase lift

Altshuler et al, The evolution of flight in both vertebrates and invertebrates has led to a wide variety of adaptations to exploit unique physiological advantages and to overcome specific deficiencies In contrast to birds, some of which hover easily or travel huge distances, batsâ€”the other group of flying vertebratesâ€”seem to be rather second-rate flyers. Furthermore, although bats travel significant distances in search of food, their range tends to be around km at most, while birds migrating between the Arctic and Antarctic cover more than 15, km. Avian adaptations have allowed birds to conquer almost the whole world, both in terms of latitude and altitude, and also to perfect hovering to an extent that bats have never achieved. But it would be a mistake to consider bats inferior to birds. They have fundamentally different wings and, although birds win in terms of efficiency and stamina, bats have the edge in aerobatic ability. Bat wings are extensions of mammalian arms and are formed by membranes with double layers of skin that join the bones of the fingers. The membrane contains a combination of muscle and elastic fibres to keep it stiff but enable it to fold. However, despite recent research into the flight of bats and hummingbirds, arguably the most exciting insights have come from flying insects, in particular about the structure of the flight muscles and their coordination with the central nervous system. Insects evolved flight much earlier than birds or bats and exhibit some of the most profound genetic adaptations. They also evolved flight with much smaller body sizes, which brings both challenges and opportunities. It seems that insect flight has gone through two stages of evolution, with some of the most successful species, including bees and all beetles, being in the second wave Iwamoto et al, The crucial difference between the two modes of insect flight is the signalling between the nervous system and the wings. This mechanism is called synchronous flight because each wing beat is generated by a single nerve impulseâ€”in the same way that humans and all mammals manipulate their limbs. Synchronous flight works well for birds, bats and larger insects, but seems not to function for body sizes smaller than that of a bumblebee. Below this size, the frequency of wing beats required to support flight becomes unsustainable using the synchronous flight modelâ€”it is physically impossible to trigger muscle contractions quickly enough. In synchronous flight, the nerve impulses trigger contractions by causing the sarcoplasmic reticulum to release stored calcium. When the calcium is subsequently pumped back to the sarcoplasmic reticulum, the contraction ends and the muscles relax, but there is a physical limit to how quickly the calcium can be moved. This solution has been adopted by the few vertebrates that have succeeded in achieving twitches faster than MHz in non-flight muscles, such as the rattlesnake and the sound-producing toadfish. However, this is not sustainable for long periods because it consumes too much energy. This system involves subordinate muscles that activate the primary flight muscle by stretching it through a mechanism that is not yet fully understood. Asynchronous flight makes hovering and other aerodynamic feats, such as flying backwards, easier to achieve and sustain. It has also allowed insects to reduce their size and to exploit local and transient pressure changes in the air to increase uplift. The physics are complex but, in essence, the wings are able to create pressure gradients that give added uplift to the insect Dickinson et al, Although the exact mechanisms of asynchronous flight are not yet fully understood, one important discovery was made recently. Micro-X-ray analysis of frozen flight muscle showed that the myofibrils are extraordinarily symmetrical, with each successive multi-protein latticeâ€”called a sarcomereâ€”arranged in precise alignment. According to Iwamoto, who first discovered this in the bumblebee, the maximum misalignment between successive sarcomeres is at most 0. He and his team went on to show that all asynchronous flight muscles exhibit this symmetry Iwamoto et al, The crystalline structure of asynchronous flight muscles has probably evolved independently several times. The X-ray diffraction patterns revealed similar regular hexagonal arrays in bees Hymenoptera , flies Diptera , beetles Coleoptera and true bugs Heteroptera ; as the last common ancestor of these groups probably flew synchronously, each group is likely to have evolved asynchronous flight independently. Furthermore, even large beetles that do not necessarily require asynchronous flightâ€”because they beat their wings slowlyâ€”maintain this ordered myofibril structure. Iwamoto suggested that their smaller ancestors probably evolved asynchronous flight and that the larger beetles retained it even when it was no longer completely necessary. In fact, asynchronous flight can be a disadvantage for larger insects with relatively slow wing beats. Large longhorn beetles, for example, which use asynchronous flight muscles like all beetles, are far clumsier in the air than other big insects with synchronous flight. Iwamoto commented that both modes have advantages and disadvantages, and that asynchronous flight is not intrinsically superior. At a reduced frequency of wing beats it becomes an advantage to control flight speed and direction by varying each flap: One clue comes from those insects that have not evolved it, but still need to hover with relatively fast wing beats to feed on nectar. The hummingbird hawk moth is such an insect: Iwamoto examined the myofibril diffraction pattern of the hawk moth and found that they exhibited some regularity in the orientation of their lattice planes, but not as much as in the muscles of asynchronous insects Iwamoto et al, The evolution of partial crystalline order in the myofibrils seems to be a necessary precursor to asynchronous flight, which allows increasing wing beat frequencies towards the limit for synchronous operation. A second clue is that, even in insects that fly asynchronously, the crystalline myofibril structure is confined to just the flight muscles. But again, this does not fully explain why the crystalline structure is so important, with the best guess being that it provides the strength or stiffness required for fast flapping and enables force to be transmitted more efficiently along the muscle fibres. However, significant progress has been made in elucidating some other features of insect flight muscles. The main demands of asynchronous flight are rapid activation and deactivation of the flight muscles, and the efficient delivery of energy. The rapid pumping of calcium from and to the sarcoplasmic reticulum, which normally occurs in muscle cells where the contraction is synchronized with nerve cells, is discarded in asynchronous flight. This allows more rapid contractions to be controlled by resonance between the wing and the thorax of the insect. It also saves most of the space occupied by the sarcoplasmic reticulum in the muscle cells of synchronous flying insects. About half the total muscle volume can then be dedicated to energy-producing mitochondria and the other half to the myofibrils that do the work Bullard et al, Another unique adaptation for asynchronous flight is a protein called flightin, which gives the myofibrils the stiffness required for rapid wing beats without losing elasticity. It is found only in asynchronous flight muscles, in addition to kettin and projectinâ€”proteins that are present in all flight muscles of insects Bullard et al, Experiments have shown that insects with a null mutation in the flightin gene are much poorer flyers Barton et al, Furthermore, mechanical analysis of myofibrils that lacked flightin showed that they had lost the required stiffness to sustain rapid wing beats. Recent work has shown that evolutionary adjustments in the elastic properties of insect wings have come about through small changes in various constituent proteins, perhaps through the selection of particular alleles within a population to produce different isoforms Bullard et al, But some insects have more specialized flight requirements than others. Although there is a general relationship between insect size and wing beat frequency, the honeybee has a much faster wing beat than would be expected on this basis alone. This mystery was cleared up in , when Douglas Altshuler and colleagues at the California Institute of Technology Pasadena, CA, USA showed that honeybees use a wing stroke of shorter amplitude but higher frequency than other asynchronous insects of the same size Altshuler et al, This adaptation generates the extra power that they need to carry heavy loads of nectar or larvae. Although research into the physics, metabolism and molecular adaptations of flight is answering many questions, it is also creating new ones. Given the unique adaptations some species have evolved to become successful flyers, it is fascinating to discover the ways in which various species have pushed their physical and metabolic abilities to the very limits. Although humans remain with solid feet of clay, the age-old dream of flight is still an irresistible fascination for those who want to understand how it is achieved. J Exp Biol J Muscle Res Cell Motil Proc Biol Sci

Chapter 8 : How do Animals Move

Ostriches use their wings sort of like rudders to help them steer while running, and their long legs can stride up to 16 feet in a single bound. Their powerful legs with their formidable two-clawed feet are potentially fatal weapons, too.

In contrast to gliding, which has evolved more frequently but typically gives rise to only a handful of species, all three extant groups of powered flyers have a huge number of species, suggesting that flight is a very successful strategy once evolved. Finally, insects most of which fly at some point in their life cycle have more species than all other animal groups combined. The evolution of flight is one of the most striking and demanding in animal evolution, and has attracted the attention of many prominent scientists and generated many theories. Additionally, because flying animals tend to be small and have a low mass both of which increase the surface-area-to-mass ratio , they tend to fossilize infrequently and poorly compared to the larger, heavier-boned terrestrial species they share habitat with. Fossils of flying animals tend to be confined to exceptional fossil deposits formed under highly specific circumstances, resulting in a generally poor fossil record, and a particular lack of transitional forms. Furthermore, as fossils do not preserve behavior or muscle, it can be difficult to discriminate between a poor flyer and a good glider. Insects were the first to evolve flight , approximately million years ago. The developmental origin of the insect wing remains in dispute, as does the purpose prior to true flight. One suggestion is that wings initially were used to catch the wind for small insects that live on the surface of the water, while another is that they functioned in parachuting, then gliding, then flight for originally arboreal insects. Pterosaurs were the next to evolve flight, approximately million years ago. These reptiles were close relatives of the dinosaurs and sometimes mistakenly considered dinosaurs by laymen , and reached enormous sizes, with some of the last forms being the largest flying animals ever to inhabit the Earth, having wingspans of over 9. Birds have an extensive fossil record, along with many forms documenting both their evolution from small theropod dinosaurs and the numerous bird-like forms of theropod which did not survive the mass extinction at the end of the Cretaceous. However, the ecology and this transition is considerably more contentious, with various scientists supporting either a "trees down" origin in which an arboreal ancestor evolved gliding, then flight or a "ground up" origin in which a fast-running terrestrial ancestor used wings for a speed boost and to help catch prey. Bats are the most recent to evolve about 60 million years ago , most likely from a fluttering ancestor [5] , though their poor fossil record has hindered more detailed study. Only a few animals are known to have specialised in soaring: Powered flight is very energetically expensive for large animals, but for soaring their size is an advantage, as it allows them a low wing loading, that is a large wing areas relative to their weight, which maximizes lift. Biomechanics[edit] Gliding and parachuting[edit] During a free-fall with no aerodynamic forces, the object accelerates due to gravity, resulting in increasing velocity as the object descends. During parachuting, animals use the aerodynamic forces on their body to counteract the force or gravity. Smaller adjustments can allow turning or other maneuvers. This can allow a parachuting animal to move from a high location on one tree to a lower location on another tree nearby. During gliding, lift plays an increased role. Like drag, lift is proportional to velocity squared. Gliding animals will typically leap or drop from high locations such as trees, just as in parachuting, and as gravitational acceleration increases their speed, the aerodynamic forces also increase. Because the animal can utilize lift and drag to generate greater aerodynamic force, it can glide at a shallower angle than parachuting animals, allowing it to cover greater horizontal distance in the same loss of altitude, and reach trees further away. This has made the flight of organisms considerably harder to understand than that of vehicles, as it involves varying speeds, angles, orientations, areas, and flow patterns over the wings. A bird or bat flying through the air at a constant speed moves its wings up and down usually with some fore-aft movement as well. Because the animal is in motion, there is some airflow relative to its body which, combined with the velocity of its wings, generates a faster airflow moving over the wing. This will generate lift force vector pointing forwards and upwards, and a drag force vector pointing rearwards and upwards. The upwards components of these counteract gravity, keeping the body in the air, while the forward component provides thrust to counteract both the drag from the wing and from the body as a whole. Pterosaur flight likely worked in a similar manner, though no living pterosaurs remain for study. Insect flight is considerably different, due to their small size, rigid wings, and other anatomical differences. Turbulence and vortices play a much larger role in insect flight, making it even more complex and difficult to study than the flight of vertebrates. Most insects use a method that creates a spiralling leading edge vortex. As they fling open, the air gets sucked in and creates a vortex over each wing. This bound vortex then moves across the wing and, in the clap, acts as the starting vortex for the other wing. Circulation and lift are increased, at the price of wear and tear on the wings. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed. The largest known flying animal was formerly thought to be Pteranodon , a pterosaur with a wingspan of up to 7. Some other recently discovered azhdarchid pterosaur species, such as Hatzegopteryx , may have also wingspans of a similar size or even slightly larger. Although it is widely thought that Quetzalcoatlus reached the size limit of a flying animal, it should be noted that the same was once said of Pteranodon. The wandering albatross has the greatest wingspan of any living flying animal at 3. Among living animals which fly over land, the Andean condor and the marabou stork have the largest wingspan at 3. There is no real minimum size for getting airborne. Indeed, there are many bacteria floating in the atmosphere that constitute part of the aeroplankton. The smallest flying vertebrates are the bee hummingbird and the bumblebee bat , both of which may weigh less than 2 grams 0. They are thought to represent the lower size limit for endotherm flight. Most flying animals need to travel forward to stay aloft. However, some creatures can stay in the same spot, known as hovering, either by rapidly flapping the wings, as do hummingbirds , hoverflies , dragonflies , and some others, or carefully using thermals, as do some birds of prey. The slowest flying non-hovering bird recorded is the American woodcock , at 8 kilometres per hour 5. The animal that flies highest most regularly is the bar-headed goose Anser indicus, which migrates directly over the Himalayas between its nesting grounds in Tibet and its winter quarters in India. This can be taken as the animal that moves most horizontal distance per metre fallen. Flying fish have been observed to glide for hundreds of metres on the drafts on the edge of waves with only their initial leap from the water to provide height, but may be obtaining additional lift from wave motion. Many gliding animals have some ability to turn, but which is the most maneuverable is difficult to assess. Even paradise tree snakes , Chinese gliding frogs , and gliding ants have been observed as having considerable capacity to turn in the air. Extant flying and gliding animals[edit] Arthropods [edit] A bee in flight. The first of all animals to evolve flight, insects are also the only invertebrates that have evolved flight. The species are too numerous to list here. Insect flight is an active research field. Directed aerial gliding descent is found in some tropical arboreal bristletails , an ancestrally wingless sister taxa to the winged insects. The bristletails median caudal filament is important for the glide ratio and gliding control [13] Gliding ants gliding. The flightless workers of these insects have secondarily gained some capacity to move through the air. Gliding has evolved independently in a number of arboreal ant species from the groups Cephalotini , Pseudomyrmecinae , and Formicinae mostly Camponotus. All arboreal dolichoderines and non-cephalotine myrmicines except Daceton armigerum do not glide. Living in the rainforest canopy like many other gliders, gliding ants use their gliding to return to the trunk of the tree they live on should they fall or be knocked off a branch. Gliding was first discovered for Cephalotes atreus in the Peruvian rainforest. The wingless immature stages of some insect species that have wings as adults may also show a capacity to glide. These include some species of cockroach , mantid , katydid , stick insect and true bug. Although typically flightless some may engage in aerial locomotion as described below. The young of some species of spiders travel through the air by using silk draglines to catch the wind, as may some smaller species of adult spider, such the money spider family. This behavior is commonly known as "ballooning". Ballooning spiders make up part of the aeroplankton. Some species of arboreal spider of the genus Selenops can glide back to the trunk of a tree should they fall. Several oceanic squids , such as the Pacific flying squid , will leap out of the water to escape predators, an adaptation similar to that of flying fish. Small fins towards the back of the mantle do not produce much lift, but do help stabilize the motion of flight. They exit the water by expelling water out of their funnel, indeed some squid have been observed to continue jetting water while airborne providing thrust even after leaving the water. This may make flying squid the only animals with jet-propelled aerial locomotion.

Chapter 9 : What Are Feathers Used For? | Ask A Biologist

Animals move in so many different ways, their bodies adapting to different calendrierdelascience.com have wings to fly in the air, fish have fins to swim in the sea and many mammals have legs to walk on the ground.

This means that the butterfly changes completely from its early larval stage, when it is a caterpillar, until the final stage, when it becomes a beautiful and graceful adult butterfly. The butterfly life cycle has four stages: Butterfly eggs are tiny, vary in color and may be round, cylindrical or oval. The female butterfly attaches the eggs to leaves or stems of plants that will also serve as a suitable food source for the larvae when they hatch. Caterpillars often, but not always, have several pairs of true legs, along with several pairs of false legs or prolegs. They have a voracious appetite and eat almost constantly. As the caterpillar continues to eat, its body grows considerably. The tough outer skin or exoskeleton, however, does not grow or stretch along with the enlarging caterpillar. Instead, the old exoskeleton is shed in a process called molting and it is replaced by a new, larger exoskeleton. A caterpillar may go through as many as four to five molts before it becomes a pupa. The caterpillar attaches itself to a twig, a wall or some other support and the exoskeleton splits open to reveal the chrysalis. The chrysalis hangs down like a small sack until the transformation to butterfly is complete. The casual observer may think that because the pupa is motionless that very little is going on during this "resting stage. The pupa does not feed but instead gets its energy from the food eaten by the larval stage. Depending on the species, the pupal stage may last for just a few days or it may last for more than a year. Once the chrysalis casing splits, the butterfly emerges. It will eventually mate and lay eggs to begin the cycle all over again. Most adult butterflies will live only a week or two, while a few species may live as long as 18 months. Images in this section are of the life cycle of the black swallowtail on one of its host plants, fennel. Butterfly activities Butterflies are complex creatures. Their day-to-day lives can be characterized by many activities. If you are observant you may see butterflies involved in many of the follow activities. To observe some activities, such as hybernation, may involve some detective work. To observe other activities such as basking, puddling, or migrating, you will need to be at the proper place at the proper time. Keep an activity log and see how many different butterflies you can spot involved in each activity. The information from the individual butterfly pages may give you some hints as to where or on what plants some of these activities are likely to occur. Back to index Feeding The larval or caterpillar stage and the adult butterfly have very different food preferences, largely due to the differences in their mouth parts. Both types of foods must be available in order for the butterfly to complete its life cycle. Caterpillars are very particular about what they eat, which is why the female butterfly lays her eggs only on certain plants. Their primary goal is to eat as much as they can so that they become large enough to pupate. Some caterpillars are considered pests because of the damage they do to crops. Caterpillars do not need to drink additional water because they get all they need from the plants they eat. Adult butterflies are also selective about what they eat. Unlike caterpillars, butterflies can roam about and look for suitable food over a much broader territory. In most cases, adult butterflies are able to feed only on various liquids. It uncoils to sip liquid food, and then coils up again into a spiral when the butterfly is not feeding. Most butterflies prefer flower nectar, but others may feed on the liquids found in rotting fruit, in ooze from trees, and in animal dung. Butterflies prefer to feed in sunny areas protected from wind. A recent University of Kentucky Department of Entomology study compared four commonly available zinnia cultivars with regard to their attractiveness to butterflies. As a result, their body temperature changes with the temperature of their surroundings. If they get too cold, they are unable to fly and must warm up their muscles in order to resume flight. If the temperature drops too low, they may seek a light colored rock, sand or a leaf in a sunny spot and bask. Puddling When butterflies get too hot, they may head for shade or for cool areas like puddles. Some species will gather at shallow mud puddles or wet sandy areas, sipping the mineral-rich water. Generally more males than females puddle and it is believed that the salts and nutrients in the puddles are needed for successful mating. Patrolling and perching There are two methods that a male butterfly might use in order to search for a female mate. It might patrol or fly over a particular area where other butterflies are active. If it sees a possible mate, it will fly in for a closer look. Or, instead, it might perch on a tall plant in an area where females may be present. If it spots a likely mate, it will swoop in to investigate. In either case, if he finds a suitable female he will begin the mating ritual. If he finds another male instead, a fierce fight may ensue. Mating A male butterfly has several methods of determining whether he has found a female of his own species. One way is by sight. The male will look for butterflies with wings that are the correct color and pattern. When a male sights a potential mate it will fly closer, often behind or above the female. The male may also do a special "courtship dance" to attract the female. These "dances" consist of flight patterns that are peculiar to that species of butterfly. They will then mate by joining together end to end at their abdomens. During the mating process, when their bodies are joined, the male passes sperm to the female. The male butterfly often dies soon after mating. Egg-laying After mating with a male, the female butterfly must go in search of a plant on which to lay her eggs. Because the caterpillars that will hatch from her eggs will be very particular about what they eat, she must be very particular in choosing a plant. She can recognize the right plant species by its leaf color and shape. Just to be sure, however, she may beat on the leaf with her feet. This scratches the leaf surface, causing a characteristic plant odor to be released. Once she is sure she has found the correct plant species, she will go about the business of egg-laying. While laying her eggs, they are fertilized with the sperm that has been stored in her body since mating. Some butterflies lay a single egg, while others may lay their eggs in clusters. A sticky substance produced by the female enables the eggs to stick where ever she lays them, either on the underside of a leaf or on a stem. Hibernating Butterflies are cold-blooded and cannot withstand winter conditions in an active state. Butterflies may survive cold weather by hibernating in protected locations. They may use the peeling bark of trees, perennial plants, logs or old fences as their overwintering sites. They may hibernate at any stage egg, larval, pupal or adult but generally each species is dormant in only one stage. Migrating Another way that butterflies can escape cold weather is by migrating to a warmer region. Some migrating butterflies, such as the painted lady and cabbage butterfly, fly only a few hundred miles, while others, such as the monarch, travel thousands of miles. Monarchs are considered the long-distance champions of butterfly migration, traveling as many as miles round trip. They begin their flight before the autumn cold sets in, heading south from Canada and the northern United States. Monarchs migrate to the warmer climates of California, Florida and Mexico, making the trip in two months or less and feeding on nectar along the way. Once arriving at their southern destination, they will spend the winter resting for the return flight. Few of the original adults actually complete the trip home. Instead, the females mate and lay eggs along the way and their offspring finish this incredible journey. Camouflage Butterflies and caterpillars are preyed upon by birds, spiders, lizards and various other animals. Largely defenseless against many of these hungry predators, Lepidoptera have developed a number of passive ways to protect themselves. One way is by making themselves inconspicuous through the use of camouflage. Caterpillars may be protectively colored or have structures that allow them to seemingly disappear into the background. For example, many caterpillars are green, making them difficult to detect because they blend in with the host leaf. Some larvae, particularly those in the Tropics, bear a resemblance to bird droppings, a disguise that makes them unappealing to would-be predators. Some may look like dead leaves on a twig when they are at rest with their wings closed. The under wing markings of the comma and question mark butterflies help them to go unnoticed when hibernating in leaf litter.