

Bats of the Chihuahuan Desert

All About Bats!



Animals are often featured in human culture, with specific aspects of their biology emphasized over others. All bats belong to the order Chiroptera, which is derived from ancient Greek and means 'hand wing.' The most common bats found in North America and Europe belong to a group called Vespertiliones which is derived from the Latin 'vesper,' meaning 'the evening.' These are just two parts of bat biology that are some of the most common—they have hand wings and are awake at night. Traits that are often emphasized in Western culture include bats' association with darkness and underground caverns (portals to underworld), avoidance of light, drinking blood, mysterious habits, and bats' erratic flight.

Since bats are active during the night, and humans cannot see as well at night we have a hard time observing them. Bats are often portrayed as mysterious and associated with the dark and the unknown. Around Halloween you often see bats associated with witches, other beings that fly at night, as in the witches' scene from Macbeth:

Double, double toil and trouble;
Fire burn, and caldron bubble.
Fillet of fenny snake,
In the caldron boil and bake;
Eye of newt, and toe of frog,
Wool of bat, and tongue of dog...

In many cultures, vampires are people who return from the dead to feed on the blood of living people. While folklore throughout the world has long associated bats with the souls of the dead and with demon, Gary McCracken, author for Bat Conservation International, has found no Old World mythology in which vampires take the form of a bat. The idea of bats turning into vampires seems to be a relatively new concept first written about in Bram Stoker's book *Dracula*, published in 1897. Although only three species of bat (out of more than 1,000 species) drink blood, bats are often associated with *Dracula*.

In Greek mythology, bats are associated with the underworld. The bat is a god of death in Mayan culture. The Egyptians used a bat to signify a man of small means and weak power. Batman chose his costume to inspire fear in his enemies, and this was also one of the inspirations for the use of bats in heraldry, such as in France, England, Spain, Switzerland, and Ireland. On coats of arms, bats are usually displayed with wings open and facing the observer. Other traits bats are supposed to represent in heraldry include watchfulness, wakefulness, and vigilance. The ability to stay awake all night is a good trait to have for a night watchman or a pilot!

Some cultures view bats differently from the traditional Western viewpoint. Gypsies consider bats good luck and the ancient kingdom of Macedonia thought bats the luckiest of all animals. Due to their longevity, bats are sometimes associated with wisdom. In the Chinese language, the word for bat is fu, which is also the name of the character meaning 'happiness.' The figure of a bat stands for happiness or good luck and is frequently seen worked into designs in Chinese handicrafts. Two bats written upon a gift signify good wishes from the donor, and a talisman

widely used in China consists of a disk about the size of a dollar, enclosing the symbol of life (a tree with roots and branches), and surrounded by five bats with spread wings, facing in.

This talisman of the five bats – or wu-fu – is worn for the five great happinesses (also sometimes referred to as the five good fortunes or five blessings) sought by all people: health, prosperity, long life, good luck, and a desire for virtue or, as sometimes put, tranquility. In Chinese art, bats (representing male traits) are often paired with peaches (which represent female traits). Peaches were cultivated in China approximately 5,000 years ago and bats, which ate the fruit, were the primary means of dispersing peach seeds.

Bats are sometimes considered creatures with a double nature – half bird, half beast. In old English, bats were called a rermouse, and in Anglo-Saxon, bats were hrere-mus, the fluttering mouse. Seventh-century sources state that the bat is a bird, but unlike other birds, it is four legged and resembles a mouse and makes a squeaking sound. This double nature is sometimes featured in the mythologies of indigenous peoples.

Many people have misconceptions about bats which help to create fear of these creatures. This also causes some cultures to destroy bats and their habitats. Knowledge is crucial to understanding these misconceptions and where they come from.

Each bat species has unique body structures, which lets them gather, catch, and eat different types of food, get water, and find shelter.

Although bats and birds both fly, they are not closely related. Birds belong to the Aves class, while bats are part of the Mammalian class. Birds are able to fly because they have hollow bones and feathers, while bats have fur and lightweight versions of mammal bones which are marrow-filled.

There are two major groups of bats, megachiroptera (megabats) and microchiroptera (microbats). Megabats all eat fruit or feed on flowers (nectar and pollen), this reduces their need for sophisticated echolocation. The two species of megabats are known to use their echolocation simply by clicking their tongues much like a human would click its tongue. Echolocation is also used by microbats however they rely more on eyesight as opposed to microbats, which do primarily use echolocation. The sounds microbats use to echolocate are created by vocalizing their larynx (those species that have a nose-leaf appear to direct sound through this facial attribute).

Echolocation

Bats use echolocation to navigate. Echolocation consists of two parts, creating sound and 'catching' sound. First, the bat emits a sound wave—frequently called 'chirping'—then the bat uses its ears to 'catch' the sound after the sound bounces off an object. Bats that use echolocation usually have large cupped ears which allow them to have very sensitive hearing. Bats that hunt at night use echolocation to find their prey. This also gives bats an advantage when hunting, since some of the insects that bats eat are only active at night such as moths. This means the bat does not have to compete with other daytime animals, such as birds, for food. Bats not only use echolocation to hunt, they use it to navigate in the dark as well. This allows them to be able to use dark places like caves as homes. Other animals that use echolocation are dolphins, whales, and shrews.

One way of describing how big cupped ears hear better is to listen to a whisper with your eyes closed. Then, cup your hands behind your ears and with your eyes still closed listen again to the whisper.

An easy way to understand the sound waves bouncing back is by comparing it to a ball bouncing on the floor which then comes directly back into your hand.

One adaptation found in many species of bats which echolocate is the tragus. This tiny sword-shaped piece of flesh is located in the ear. This structure is believed to aid in echolocation and is frequently used to help scientists identify species.

Why can't we hear a bat's chirp? Bats make very high pitched sounds that are outside the human range of hearing. These sounds move through space in waves. These waves are measured in hertz. Each measured hertz equals the number of times the sound wave vibrates per second. Humans can only hear sound waves that vibrate between 20 and 20,000 times per second. A bat's chirp vibrates more than this. It is like a dog whistle. Most people cannot hear the whistle but dogs, because of their higher range of hearing, can. This is how echolocation works: as bats fly, they issue a continuous stream of high-pitched sounds waves that move through the air and bounce off objects. The vibrations that bounce off objects then echo back to the bat. The pattern formed by the echoes tells the bat of the obstacles size, shape, and location.

Bats have eyes much like humans. While they cannot see in the dark they are able to navigate in darkness using echolocation. This allows bats to avoid obstacles such as people, trees, and cave walls. It is unlikely that a bat would intentionally fly into a person or their hair.

Nocturnal Creatures?

Not all bats fly at night. Some, like the Australian Fox Bat, are active during the day. This means they are diurnal. Nocturnal species of bats sleep during the day and fly at night. This allows them to hunt for food with less competition from other diurnal animals. Additionally, some bats hunt at night because the food they eat is only available after dark, such as moths and certain types of flowers.

Physical Characteristics & Adaptations

Bats, like people, have teeth that they begin their life with called milk teeth, which they lose and replace with permanent teeth. Different species of bats have teeth that are adapted to the kind of food they eat. Vampire bats have sharp front teeth which they use to bite an animal's skin. Then they lick up the blood using grooves on their tongues to help move the blood (via capillary action) into their mouths. Since a liquid diet requires no chewing, vampire bats have only 20 teeth. Bats that feast on nectar usually have fewer teeth and some do not have teeth on the bottom at all, as they use their tongues to reach down into flowers for pollen and nectar. Bats that eat meat and insects usually have more teeth that are adapted to the type of food it eats.

Bats eyes range in size and this determines how much they use their eyes for orientation. As discussed previously, the majority of bats echolocate. Bats with smaller eyes do not rely too heavily on their sense of sight to find their way. These bats rely mostly on echolocation. They use their sense of sight when light is available however, scientists do not understand exactly how much bats can actually see. To answer this question, scientists are conducting laboratory studies that test the ability of the bat to see and recognize different patterns and targets. Bats with large eyes do not often have the ability to echolocate and are usually crepuscular (active at dawn or dusk). Two examples of bats with large eyes are Wahlberg's epauletted fruit bat and Lyle's flying fox. Other bats that eat fruit and nectar are nocturnal and also have larger eyes to help them see at night.

Even though bats rely heavily on their other senses to get around and hunt, they do use their sense of smell to locate offspring. A mother bat can find her offspring in a crowd of over 20 million bats! In many large colonies, millions of babies cluster at up to 500 individuals per square foot. Mothers and pups recognize each other's unique voices at least three feet away and move toward one another despite the incredible confusion of calls emanating from countless thousands of bats. Multiple landings are typically required to find a pup (baby bat), each linking its location in a manner suggesting that a mother is triangulating her pup's voice. Finding her young can take as little as 12 seconds or as long as 10 minutes. She most commonly feeds her pup before she goes out to feed and again when she returns in the morning.

It remains to be discovered whether this sense a mother uses is placed on the pup from glands on the mother's face or whether each pup has its own unique odor.

One adaptation some bats have is a nose-leaf. A nose-leaf is a triangular piece of flesh that projects from the tip of a bat's snout. They are only found on bats that send out echolocation sounds through their noses. Nose-leaf bats appear to direct sound when using echolocation. One bat that has a nose-leaf is the California Leaf-nosed bat. It lives in Southern California, the very southern tip of Nevada, and the western half of Arizona. The Jamaican Leaf-nosed bat also has a nose-leaf and eats fruit (and is also referred to as the Jamaican Fruit Eating bat). This adaptation allows it to carry fruit in its mouth and echolocate at the same time.

Like people, bats have arms and five fingers. Bat fingers are much longer than our fingers and they are connected with a membrane forming the wing. For our fingers to be as long as bats' fingers, ours would have to go all the way down to our ankles! By having their arms and fingers connected by skin, a bat is able to fly. This offers escape from predators and the ability to capture prey or fly between fruit trees. Similar to our thumbs, a closer look at bat thumbs reveal that they are shorter than their fingers and are used as hooks to move around on cave ceilings.

While hanging upside down, a bat's grasp is closed as the muscles are relaxed. This allows bats to stay in areas that predators cannot reach, take off easily, and raise their young in the warmer temperatures. Some bats use their feet and razor sharp claws to catch fish or newly hatched insects from a water surface. Their feet also have a special hinge that tightens when weight is added to the claw. When a bat is at rest, its entire body weight hands suspended from its toes. Bat feet are designed differently from human feet. When the bat's weight pulls down on the tendon, the claw clenches more tightly over the perch, so that the bat doesn't have to work to keep its toes curled, unlike us. When the bat takes off in flight, the tension on the tendon is released, and the claw releases its hold. This tendon-locking system works so well that bats may remain hanging from a perch even after they have died! Some bats have feet which are

very specific to the type of food they eat. Fish-eating bats, like the bulldog bat, have very large feet that they use to catch fish.

Habitats and Environment

Three things that every animal needs for survival are water, shelter, and food. Bats, like humans, need these basic things to live. Bats have interesting and novel strategies which allow them to survive.

All bats need a source of water and commonly drink from streams, lakes, ponds, water that drips from cave walls, and irrigation canals. Many bats fly over water and skim the surface to drink. Imagine having to run by a garden hose with your mouth open! In arid areas depleted of natural water resources, cattle water troughs become an important source of water for many bats. In these areas, water troughs are visited by bats every second! But there can be problems associated with this human-made water source. Many animals, including bats, drown when they hit human made obstacles near water sources. Fortunately this result can be easily avoided by adding wildlife escape structures to such water sources.

Bats can find shelter in a wide variety of places, some quite unexpected. Natural shelters are varied between species. In general, bats like areas that are somewhat enclosed, protected from disturbances, and dark. Some species of bats consistently sleep on the ceilings of caves where they are out of reach from predators (though raptors and owls hunt bats at cave entrances as they fly by). Not all bats live in caves as some, like the Long-eared Myotis, find shelter under a large piece of tree bark. Like these, the big brown bat traditionally roosts beneath loose bark and in small tree cavities. Buildings, barns, and the underside of bridges are also used as shelters. Fruit-eating bats found only in the tropics live in treetops. A few species of bats have an interesting way of making their home with leaves, or have very specialized roosting areas. The uroderma bilbatum, or Tent-making bat as its common name implies, chews the strong points of a leaf (veins and mid-ribs) so that it sags. They then use the modified leaf as a roost. The banana bat, or pipstellus nanus, roosts only in bamboo stems. What would happen to these bats if there were no banana trees or bamboo plants? As natural bat habitats diminish, bats get creative in finding human built structures to sleep in—that's why building bat houses can be such a great idea. Bats also use abandoned mines, attics, eaves, and abandoned animal dens as roosts. Some cities in Texas even have engineers incorporate special structures into bridges that serve as bat roosts!

Bats have many natural enemies and large numbers of them die while still young. Some of the hazards include great horned owls, some species of hawks, Peregrine falcons, raccoons, house cats, and snakes. Bats can be caught on barbed-wire fences, fall from a roost, or die if their cave is flooded. The most significant causes of premature bat death, however, are the activities of people. Bats are in serious decline nearly everywhere. Forty percent of the bats in the U.S. and Canada are endangered or candidates for such status. Even small disturbances in their habitat can seriously threaten their survival. Use of insecticides in agriculture is responsible for killing bats in great numbers. When bats consume the chemical-laden insects, the bats become poisoned and die.

There are many factors that lead to the misconceptions surrounding bats. They are the only mammals the fly which makes them unique in the animal kingdom. Their association with the night also leads to associations with fears of the unknown. They are, however, creatures whose

adaptations can be answered in science. The more we know about bats, the less we have to fear and the more we can understand their place in our ecosystem.