

How Hibernation Works



Every living animal on [Earth](#) is burning energy all the time. Physical activities like walking and breathing burn energy. Pumping [blood](#) and [digesting](#) food burns energy. Even thinking burns energy. For warm-blooded animals, a lot of energy is burned just keeping our body temperature where we need it. Even when we're [sleeping](#), we're burning energy.

That's the whole reason animals eat -- to gain enough energy to fuel all those processes. The system works fine when there's plenty of fruit on the trees or rabbits to catch and eat. But what happens when winter comes and it becomes very difficult to find food? How do animals survive with few energy sources available?

There are many winter survival strategies in the animal world, and one of the most fascinating is hibernation. Some animals enter a state of "suspended animation." Their breathing and [heart](#) rates slow and they allow their body temperature to drop, in some cases even below freezing. They stop eating and in many cases stop excreting. All of these things happen so the animal can use less energy.

Whether an animal hibernates or migrates to a warmer area is generally a quirk of [evolution](#). Smaller animals tend to be more likely to hibernate, because [migration](#) would require an enormous amount of energy relative to their body size. Larger animals are less apt to hibernate because of the additional energy required to warm up a large body.

Hibernation is more varied than you might think. Many animals hibernate in a den all winter, but some animals hibernate in the summer. Some fish can hibernate in a waterproof mucus envelope if their lake dries up. Certain birds and [bats](#) enter a sort of daily hibernation called torpor.

Hibernation is any long-term reduction in body temperature ([hypothermia](#)) and metabolism during winter months. When an animal enters a hibernationlike state during the summer, it's known as [estivation](#). It's much less common than hibernation. Hibernation in reptiles is sometimes called [brumation](#). It differs from mammalian hibernation because reptiles are cold-blooded -- they can't control their own body temperature, so they need to spend the winter in a place that will stay warm enough.

Torpor is short-term periods of reduced temperature that occur as often as every day and only for a few hours at a time. Many species of birds use daily torpor to get through colder months. The black-capped chickadee is a good example. Daily torpor (which really ought to be called nightly torpor) is like low-grade short-term hibernation. It only lasts for a few hours, and the reduction in body temperature's just a few degrees. However, studies have shown that those few degrees save a significant number of [calories](#) from being burned off overnight.

What's the Difference Between Hibernation and Sleep?

So is hibernation basically a really long they're undergoing physiological significant element of hibernation is a much as 63 degrees F. A hibernating the vital signs of an awake animal.

Sleep, by contrast, is a mostly mental sleep that are similar to hibernation, and lowered body temperature, but hibernation. Sleep is also pretty easy to your deepest sleep, you can be fully primarily characterized by changes in hibernating animals closely resemble they're somewhat suppressed. When exhibits many signs of sleep next few days to recover.



Early spring sun makes it warm enough to wake up a hibernating black bear.

nap? No. These animals aren't just [sleeping](#), changes that can be very drastic. The most drop in body temperature, sometimes as animal's vital signs are very different from

change. There are physiological aspects of such as a reduced [heart](#) and breathing rate these changes are very slight compared to break out of -- if you're awakened from even awake within several minutes. Sleep is [brain](#) activity. In fact, the brain waves of their wakeful brain wave patterns, though an animal awakes from hibernation, it deprivation and needs to sleep a lot over the

Do zoo animals hibernate?

Zoo animals often live in environments different from their natural home, so they may not encounter the environmental cues that would normally set off their hibernation instinct. They're also fed every day and may be provided a warm place to hang out and sleep in. However, some zoos intentionally trigger hibernation in some species to give them more natural life cycles.

Knowing When To Hibernate (and When To Wake Up)

Different animal species hibernate at different times, and each species has a different way of knowing when the time is right. Hibernation is most closely regulated by temperature. When it gets cold outside, animals get ready to hibernate. When it warms up, they wake up. Therefore, hibernation periods can vary depending on the weather that year. An Indian summer and an early thaw could result in a very short hibernation.

Some species keep a close eye on their **food** supplies. When they dwindle, the animal knows it's time to gather up whatever is left and turn in for the winter. **Photoperiod** (the length of the day) triggers hibernation for others.

Even if an animal has no idea what the outside temperature is, how early the **sun** is setting or the current state of food supplies, many would still enter a hibernation state around the same time each year. Experiments under these conditions have proven that some species will automatically enter hibernation at the appropriate time, guided by an internal biological "calendar". These **circannual rhythms** aren't fully understood, but all animals are affected by them, even humans. Animals that go into daily torpor depend instead on **circadian rhythms**, the daily version.

Preparation is required to hibernate successfully. Some animals prepare a den (also known as a **hibernacula**) and line it with insulating material, just as leaves or mud. Ground squirrels and lemurs do this. Polar bears dig tunnels in the snow. Other bears might spend the winter in a hollow beside a tree or a shallow cave, leaving them partly exposed to the weather. **Bats** are well-known for wintering in caves or attics.

Next comes food storage. Food can be kept in the den if it's nonperishable, but this requires the animal to wake up briefly during the winter to eat. Another option is to eat a large amount of food starting in late summer, building up a reserve of internal **fat**. Some animals even do both. If enough food can't be found to prepare for hibernation, it can be delayed.



Chipmunks use their expandable cheek pouches to carry large amounts of food back to their nests, where they store it

Paper Walls

White-faced hornets build nests out of paper. They make it by scraping wood and mixing it with saliva before forming it into rooms and chambers. The nest grows larger throughout the summer, eventually getting about as large as a basketball. When winter arrives, there are many layers of paper making up the nest, and a layer of air in between the paper. This provides excellent insulation. The hibernating hornets vibrate their wings periodically, giving off body heat that keeps the nest just warm enough for the queen to survive and start another nest in the spring.

The Nuts and Bolts of Hibernation

Hibernation is mainly controlled by the endocrine system. Glands in the body alter the amounts of hormones being released and can control just about every physiological aspect of hibernation.

- Thyroid - gland that controls metabolism and activity levels
- Melatonin - hormone that controls the growth of winter coats
- Pituitary - gland that controls **fat** buildup, **heart** rate and breathing rate, as well as metabolic functions
- Insulin - hormone that regulates the amount of glucose (sugar) needed by the animal

When a mammal enters hibernation, it becomes somewhat like a cold-blooded animal. Its body temperature will vary depending on the temperature around it. However, there is a minimum temperature, known as a **set point**. It's just like setting the temperature on your **thermostat** at home.

When the mammal's body temperature reaches the set point, the metabolism kicks in and burns some fat reserves. This generates some energy, which is in turn used to heat things back up above the set point. Larger animals have a higher set point. If they let their temperature drop too low, it would require an enormous amount of energy to heat back up again.

Several other things occur when an animal is hibernating:

- Heart rate drops to as little as 2.5 percent of its usual level. A chipmunk's heart rate slows to five beats per minute from the usual 200.
- Breathing rate drops by 50 percent to 100 percent. Yes, 100 percent. Some animals stop breathing entirely. A few reptiles go their entire hibernation period without breathing, and even mammals have shown the ability to survive with drastically reduced oxygen supplies.
- Consciousness is greatly diminished. This varies by species, but many hibernating animals are completely oblivious to their surroundings and are nearly impossible to wake up. If you were to wake up a hibernating animal midwinter, you would be effectively killing it. It would use up so much energy warming itself up in order to awaken that it would have no chance of making it to spring even if it could re-enter hibernation.

Body fat, which is packed with energy, is burned off to provide the energy necessary to maintain these minimal levels of body functions. This can be very efficient -- Arctic ground squirrels live entirely off of stored body fat for as long as nine months. Some species are unable to store enough body fat, so those animals have a lighter hibernation, allowing them to awaken periodically for a snack.

If an animal is burning fat or snacking on stored nuts all winter, what happens to all the waste? No fecal matter is produced because nothing is passing through the **digestive tract** and intestines. But the body is always producing **urea**, the waste product that is the main component of urine. Hibernating animals' bodies are able to recycle the urea. Bears don't urinate all winter, but they break the urea down into amino acids. Even though they don't drink, they don't get dehydrated either. They're able to extract enough water from their own body fat to stay hydrated.