Hibernation Encyclopedia Article

Hibernation

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Hibernation

Hibernation, or winter dormancy, is the act of passing the cold season in a dormant physiological state of low metabolism. Hibernation is a common trait in many animals living in ecosystems having a prolonged cold period during the winter.

Many invertebrates that hibernate must be capable of withstanding extreme cold conditions. To prevent damage to their cells and tissues caused by needle-like ice crystals, they may develop extremely high concentrations of dissolved substances (such as specialized proteins or sugars) in their plasma, which prevents freezing unless super-cold temperatures occur. However, many terrestrial invertebrates are capable of being frozen solid for months during hibernation, without apparent ill-effect. Two examples are the goldenrod gall fly (*Eurosta solidaginis*) and the yellowjacket wasp (*Vespula maculata*). A few species of vertebrate animals can also survive the freezing of much of their body water, including the wood frog (*Rana sylvatica*), chorus frog (*Pseudacris triseriata*), and hatchlings of the painted turtle (*Chrysemys picta marginata*).

Some species of mammals spend the winter in a deep sleep, which conserves energy associated with movement and other activities. Such species include the black bear (*Ursus americanus*) and raccoon (*Procyon lotor*). This condition is considered to represent an extreme lethargy, rather than a true hibernation, which would be accompanied by significantly reduced body temperature.

Many species of hibernating mammals lower their body temperature greatly during hibernation, achieving a condition known as hypothermia. Examples include the woodchuck (*Marmota monax*), the golden-mantled ground squirrel (*Citellus lateralis*), and the little brown bat (*Myotis lucifugis*). Another is the poor-will (*Phalaenoptilus nuttallii*), the only bird known to hibernate. Hypothermia is an adaptive trait associated with hibernation, because of the large energy savings achieved by not keeping the body at the warm temperature required for normal activities during the active season (typically, the energy expenditure is less than about 2-6% of normal). The characteristics of the hypothermic condition during hibernation include a low body temperature, oxygen consumption as low as 1-5% of that occurring during normal basal metabolism, extremely slow breathing rate, a state of dormancy that is much more profound than deep sleep, and a reduced heart rate. The ability to arouse upon stimulation is usually maintained, although this response is slow and groggy, and requires the re-activation of the normal metabolic rate and functions. Once suitable environmental conditions occur in the springtime, the hibernating mammal increases its metabolic rate, and can resume its normal activities.