

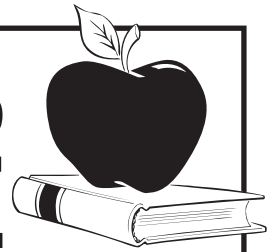
GRADE LEVELS: 1, 3

CORRELATION TO NEXT GENERATION SCIENCE
STANDARDS: 1-LS3-1, 3-LS1-1, 3-LS3-1

SKILLS/PROCESSES: observation, data collection & interpretation, comparison & generalization, grouping, fact-finding, identification, charting/graphing

OBJECTIVE: Students will become familiar with hibernation and its function as a survival technique for certain mammals.

TEACHER'S GUIDE



UNIT TWO ■ LESSON TWO

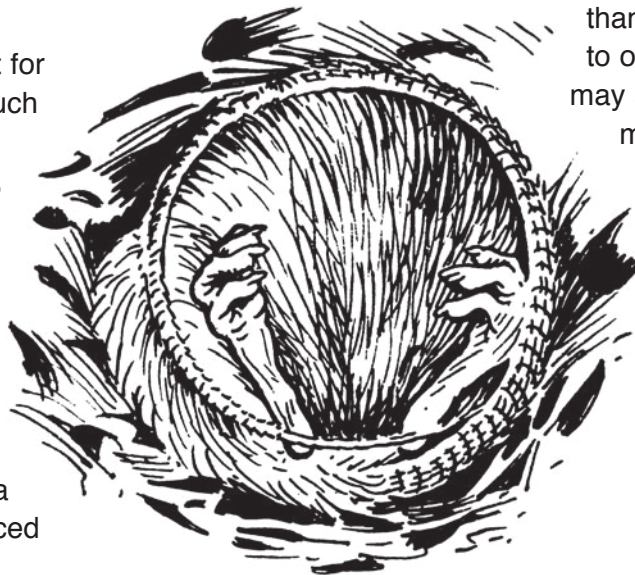
Hibernation

BACKGROUND

Survival may be difficult for mammals in climates such as we have in Illinois, particularly when harsh, prolonged winters drastically reduce the natural food supply. One of the most fascinating techniques some mammals use to deal with such conditions is **hibernation**, a state of extremely reduced **metabolic** processes.

Hibernation is seldom an all-or-nothing condition. Many mammals use varying degrees and lengths of **dormancy**, or inactivity, to conserve energy and survive periods of limited food supply. Skunks and raccoons, for instance, “den up” during extremely cold weather, remaining in their burrows and living off excess body fat, while not actually hibernating.

True hibernation involves drastic reductions in a mammal’s bodily functions as well as physical activity. Body temperature drops dramatically, as do heart and breathing rates. From a normal body temperature of 95°F, the temperature of a hibernating mammal may be as low as 36°F. A normal heart rate of more



HIBERNATING
MEADOW JUMPING MOUSE

than 100 beats per minute may drop to only four or five, and breathing may slow to less than one breath per minute. Woodchucks are an example of a true hibernator.

Prior to the hibernation period, these mammals accumulate a thick layer of excess body fat, which supplies them with the energy needed to survive. A hibernating mammal may lose as much as one-third of its total body weight during hibernation.

Others gather and store a supply of food to eat during brief periods of wakefulness.

Scientists have discovered that even during hibernation there are periods of wakefulness, which become more frequent as the hibernation period comes to an end. External temperature is a factor in these periods of sporadic activity. For each species there is a **critical temperature** above which they will waken, and all will waken temporarily if the temperature drops so low that they are in danger of freezing. Wakening allows mammals to move to a deeper, warmer chamber or to warm up a little—by shivering or moving around—until the temperature moderates.

As spring approaches the air warms, food supplies are once again sufficient, and the hibernating mammals return to normal activity.

PROCEDURE AND DISCUSSION

Review the student information with the class. Emphasize hibernation as a survival technique. Note that hibernation is designed to protect mammals from food shortages, not from low temperatures.

1. What is hibernation?

Hibernation is a state of reduced metabolism, similar to a very deep sleep, that allows a mammal to survive periods of food scarcity.

2. Why do some mammals hibernate?

Some mammals hibernate in order to survive during periods of inadequate food supply.

3. How do hibernating mammals live?

During hibernation, mammals live on accumulated excesses of body fat.

4. What will cause a hibernating mammal to awaken?

For all hibernating mammals there is a critical temperature above which they will waken. They will also rouse temporarily if the temperature drops so low that they are in danger of freezing.

5. What is metabolism?

Metabolism is the rate at which a living creature uses the energy it gets from its food.

VOCABULARY

critical temperature—the temperature at which a hibernating mammal will automatically waken (varies from species to species)

dormancy—a condition of inactivity or sleep

hibernation—a state of reduced metabolism, like a very deep sleep, which allows an animal to survive periods of food scarcity

metabolism—the rate at which a living creature uses the energy it gets from its food

CHALLENGE YOURSELF EVALUATION

1. Some animals hibernate to survive during periods when food is not readily available.
2. Hibernating mammals live on stored body fat.
3. A hibernating mammal will awaken at a critical temperature or if the outside temperature becomes too low and its body might freeze.
4. In hibernation, the animal's metabolism slows down as does the heart rate, body temperature and breathing. Hibernation lasts for months during which the animal lives off its body fat. Hibernation is controlled by temperature. In sleep, the metabolism of the organisms does not change drastically. Sleep is a state that an organism can enter and leave easily. Sleep does not last for long periods of time.
5. Hibernating animals spend several months doing nothing. They must complete all of their other life functions while not in the hibernating state.

ACTIVITY PAGE EVALUATION

1. Plants, insects and seeds make up the diet of the hibernating species.
2. They hibernate so long because during the time they are hibernating their food supply is gone. They wait for it to return.
3. Answers will vary.

EXTENSION

The woodchuck, or groundhog, and February 2 have become very closely associated. Research Groundhog Day and its origin. Is it based on scientific research?

Hibernation

STUDENT'S GUIDE

During harsh, cold winters like we have in Illinois, many of the foods mammals need become scarce or are not available. In order to survive these periods of limited food supply, some mammals hibernate. **Hibernation** is like a very deep, long sleep. This condition of **dormancy**, or inactivity, allows a mammal to live a long time on very little food.

The rate at which a living creature uses the energy it receives from food is called **metabolism**. During hibernation a mammal's rate of metabolism is slowed substantially.

Also during hibernation, a mammal's body temperature drops greatly as does its heart rate and breathing rate. While a normal body temperature may be 95°F, during hibernation it can drop as low as 36°F. A normal heart rate of over 100 beats per minute may drop to only four or five per minute. Breathing may slow to about one breath per minute.

Before they begin hibernation, mammals eat so much that they develop a thick layer of fat. This fat will supply them with the energy they will need during their long "nap." Some hibernating mammals will lose as much as one-third of their total body weight during hibernation. Mammals that do not hibernate deeply gather and store food to eat during wakeful periods.

Hibernation is never continuous. There are always periods of wakefulness, which become more frequent as the hibernation period comes to an end. For each species that hibernates there is a **critical temperature** above which they will wake, and they will wake temporarily if the temperature drops so low that they are in danger of actually freezing. Upon waking they can move to a



HIBERNATING
THIRTEEN-LINED
GROUND SQUIRREL

deeper, warmer chamber or warm up a little by shivering or moving around until the temperature rises.

As spring approaches and the air warms, food is once again available, and the hibernating mammal will waken and return to normal activity.

CHALLENGE YOURSELF

1. Why do some animals hibernate?
2. What do hibernating mammals live on?
3. What will waken a hibernating mammal?
4. How do you think hibernation is different from regular sleep?
5. What do you think might be a disadvantage of hibernation?

VOCABULARY

critical temperature
dormancy

hibernation
metabolism

ACTIVITY PAGE: Investigating Hibernation

What you will need

- paper
- pencil or ink pen

WHAT YOU DO

Eleven Illinois mammal species hibernate in winter. Study the chart and answer the questions.

| Species | Diet | Time Spent Hibernating |
|--------------------------------|-----------------|------------------------|
| little brown bat | insects | six months |
| Indiana bat | insects | six months |
| southeastern bat | insects | six months |
| northern bat | insects | six months |
| tri-colored bat | insects | six months |
| big brown bat | insects | six months |
| eastern small-footed bat | insects | four or five months |
| woodchuck | plants | five or six months |
| Franklin's ground squirrel | plants, insects | six or seven months |
| thirteen-lined ground squirrel | plants, seeds | six months |
| meadow jumping mouse | seeds | six or seven months |

1. What makes up the diet of these mammal species?
2. Why do you think they hibernate so long?
3. Construct a time line showing what events normally happen in your life during the six or so months these mammals are hibernating. Use October through March for the time line. Include events like school, sports, birthdays, etc. Write a paragraph explaining the time line.