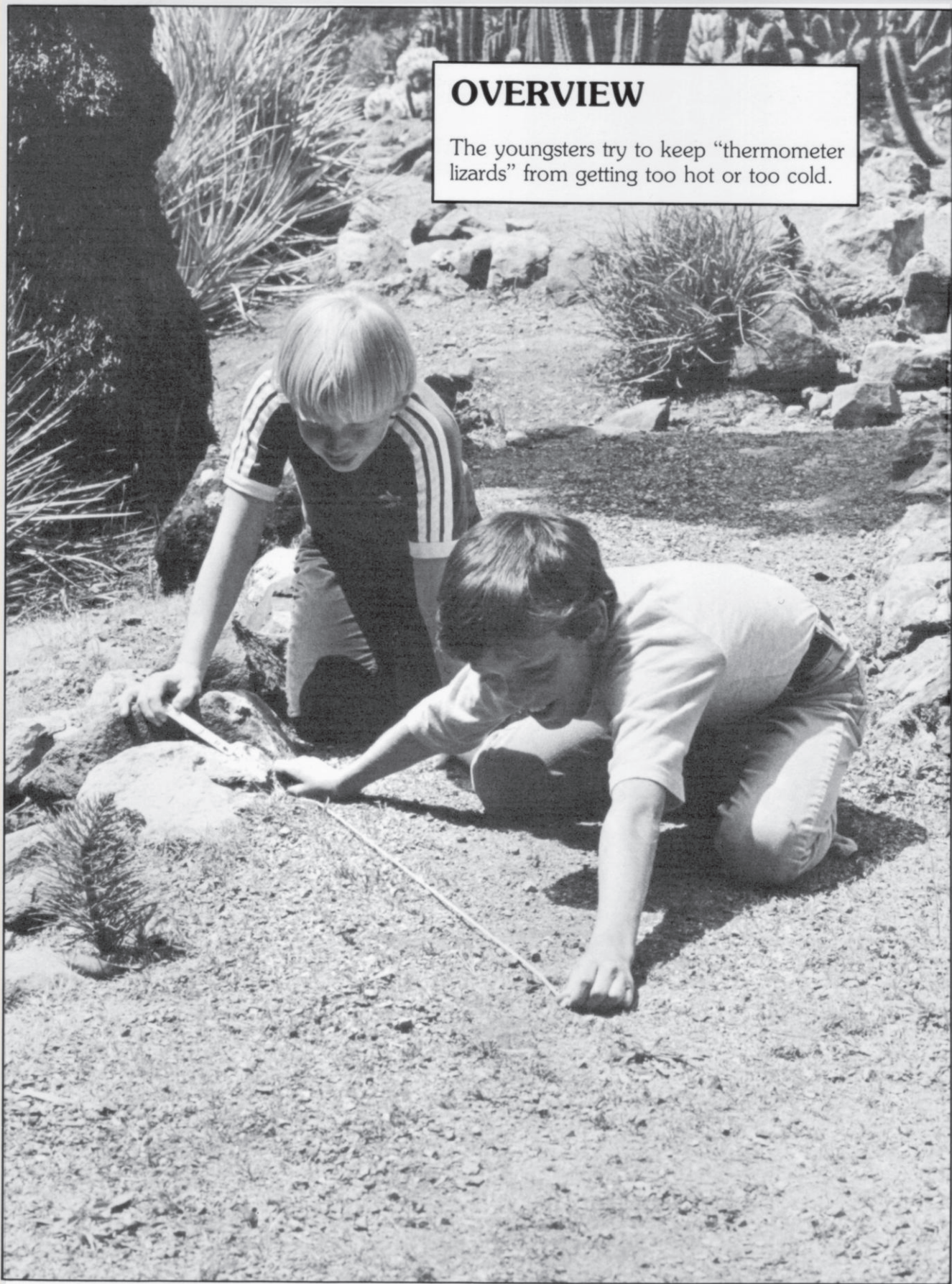


COOL IT

OVERVIEW

The youngsters try to keep "thermometer lizards" from getting too hot or too cold.



BIO
KEY

Simulation
Animal Behavior
Temperature Regulation

BACKGROUND

All animals must maintain body temperatures within certain ranges to stay active and survive. Animals can be divided into two general groups according to the way they maintain their body temperatures. Warm-blooded animals, called **endotherms** ("inside heat") by scientists, produce heat within their bodies to maintain a fairly constant body temperature, regardless of outside temperatures. Humans, other mammals, and birds control their body temperatures in this way. All other animals obtain most of their heat from the environment and are referred to as *cold-blooded* animals or **exotherms** ("outside heat"). Many exotherms regulate their body temperatures by moving into warmer or cooler spots in their environment. Lizards and snakes, for example, alternate between basking in the sun and resting in the shade to keep their body temperatures within the range that permits them to stay active. Exotherms can also regulate their body temperature by burrowing and by varying the angle of their exposure to the sun.

CHALLENGE: KEEP YOUR THERMOMETER-LIZARD "ALIVE" BY KEEPING ITS TEMPERATURE WITHIN THE FIVE-DEGREE SAFE RANGE.

MATERIALS

For each team of two:

- 1 Celsius thermometer* (with a metal back, if possible)
- 1 one-meter length of string*

For the group:

- 4 to 8 flags on small sticks* or dowels
- masking tape*
- 1 watch with a second hand
- 1 eight-meter length of rope* or string

* Available from Delta Education.

PREPARATION

Group Size. This activity works well with any size group. (See the "Lizard Course" section below.)

Time. Plan on fifty to sixty minutes for this activity.

Site. This activity must be conducted on a warm, sunny day in a site with areas of deep shade, bright sun, and broken or partial shade.

The Lizard Course. In the center of the activity area, use a stick to draw a starting circle two meters in diameter. Set up four flags (or one flag for every four youngsters, if your group is larger than sixteen) each eight meters away from the outside of the circle to mark the finish points. (Use the eight-meter piece of rope to measure the distance.) The paths from the starting circle to each flag should pass through both sunlight and shade. One path should be mostly in sunlight, one mostly in shade, and the others in a combination of sun and shade.



Thermometers. Tie a one-meter length of string to each thermometer. If the thermometers have both Celsius and Fahrenheit scales, cover the Fahrenheit scale with masking tape. Practice measuring air and ground temperatures with a thermometer so you will be able to demonstrate its use to the group. **Note:** Allow one full minute for the thermometer to register the correct temperature. Hold the thermometer at the top so the heat from your hand won't affect the reading.

ACTION

1. Let the youngsters pair up, and give one thermometer to each team. Explain how to read the thermometer, and then challenge each team to find the highest and the lowest temperatures in the activity site.

2. After about five minutes, call the group together. Add the highest temperature found by the group to the lowest temperature and divide by 2 to find the average temperature. Instruct the teams to place one piece of masking tape on their thermometer 3° above the average temperature and another piece of tape 2° below the average.



3. Ask if anyone in the group has ever had a fever. Explain that humans and other mammals produce heat inside their bodies and have a steady temperature regardless of outside temperatures. If our body temperatures go up or down even a few degrees from 37° C, we can get sick or even die.

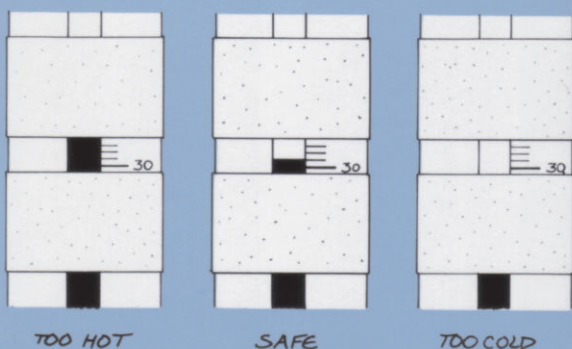
4. Explain that unlike humans, animals such as lizards, snakes, and frogs get most of their body heat from their surroundings. On hot days, a lizard's body temperature goes up; on cold days, the lizard's body temperature goes down.



5. Tell the youngsters that they are going to play a game in which they pretend their thermometers are a special kind of lizard. These "lizards" can move only one meter before they must rest for thirty seconds, and can keep active only if their temperatures remain within the range between the pieces of masking tape (that is, within the five-degree range).

6. Ask one of the youngsters to help you show how to use the one-meter string when moving a lizard. Your helper should place a finger on the string end of the lizard to hold the lizard in place on the ground. Holding the free end of the string, move the string around until you find a likely resting spot for the lizard. The new resting place cannot be more than one meter away from the lizard. When you find a likely resting place, place the end of the string on the ground at that spot and have your helper move the lizard to that spot. Explain that the teams will repeat this procedure every thirty seconds.

7. Give the youngsters the following rules:
 - a. The circle is the starting area and the flags are the finish points. Each team must try to move its lizard to one of the finish flags.
 - b. The lizards don't have to move in a straight line to the flag; this is *not* a race, but a challenge to keep the lizards active until they reach the flag.
 - c. Every thirty seconds, the leader will yell "Go!" The teams can move their lizards up to one meter (the length of the string) at a time, and must remain at that spot until the leader says "Go!" again.
 - d. Team members cannot use their bodies to shade their lizard.
 - e. If a team's lizard gets too hot or too cold, that team must drop out and wait until the next game. (Unsuccessful teams may want to continue moving their lizards to practice for the next game.)



8. Assign a finish flag to each team. (More than one team can try to reach the same flag.) Have each team place its lizard on the edge of the starting circle. Challenge the youngsters to keep their lizards "alive" by keeping their temperatures within the five-degree safe range. Check each team's lizard to make sure the lizard's temperature is in the safe range and let the game begin.

9. After the first game, ask the youngsters which lizards reached their finish flags. What strategies did successful lizards use? What problems did unsuccessful lizards have that caused them to "die"?

10. Let the teams switch finish flags and play several more games. Have the teams share any special strategies or problems.

11. Explain that different kinds of lizards live within different temperature ranges. Tell the teams that they can make different kinds of lizards by moving the five-degree range up or down on their thermometers. Challenge the teams to change the temperature range for their lizards so that they can move over a previously unsuccessful pathway. Tell them that the high and low temperatures must still be 5° apart. After the teams have changed their temperature ranges, play another round.

HEATED DEBATE

1. What temperature ranges were successful in the sun? In the shade? In partial shade?
2. What might happen to a desert lizard if you took it home as an indoor pet?
3. What ways could lizards cool off or heat up other than by moving to the shade or sunlight? How do you cool off when you get too hot?
4. What do you do now that you could not do if your body temperature responded to surrounding temperatures in the same way as your lizard?
5. Introduce the terms **endotherm** and **exotherm** to the group. (See the "Background" section.)

BRANCHING OUT

Real lizards commonly burrow into the ground to escape hot and cold temperatures. Let the teams play another game in which they can bury their lizards in order to maintain the lizards' temperature at a safe level. Suggest measuring the temperature of the ground at different depths.

