PREPARATION: Mark off migration course.

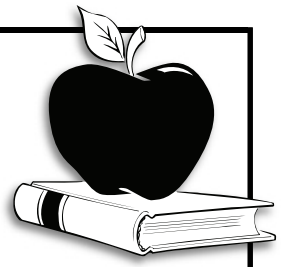
CLASS TIME: two class periods

VOCABULARY: migration, orienteering, magnetic field

MATERIALS: one compass per group; ribbons to mark off orienteering course; index cards; a map of the stars

ILLINOIS LEARNING STANDARDS: physical development and health 21.B.2, 21.B.3

TEACHER'S GUIDE



ACTIVITY

Migrateering

OVERVIEW
By completing an orienteering course, students learn about bird migration.

CONCEPTS
Some birds migrate to meet their habitat needs.

OBJECTIVES
Students will be able to: 1) use a compass to complete an orienteering course; and 2) compare human and bird navigation methods.

KEY POINTS
- Birds use a variety of senses and cues to navigate and orient during migration.
- One way some birds navigate is by orienting themselves in relation to the earth's magnetic field.

TEACHER BACKGROUND
Migratory bird species use different senses and cues to navigate and orient during migration. From banding birds, researchers know that some species can return to the same breeding ground or winter feeding site with incredible precision year after year. In fact, year after year the same individual bird can return to the same patch of forest in Illinois after wintering in Latin America! Others always return to the same region. While scientists don't have concrete answers as to how birds accomplish this amazing navigation, there are several theories.

In general, research supports the idea that birds use a combination of genetic and environmental cues to orient or navigate during migration. First, the sense to migrate in a general direction is, at least in some bird species, genetic. Researchers have studied a phenomenon known as migratory restlessness in some bird species. If confined in experiments when they should be migrating, some species exhibit a frantic behavior indicating their desire to move, to migrate. Often, the birds orient in a specific direction, such as north. Migratory behavior is not learned—many forest species don't migrate as family groups and often the young make their first journey without adults.

Other research indicates that some bird species use landmarks such as mountains and bodies of water, or more recently, city lights, to give them visual environmental cues as to their location. This theory is strengthened when we consider the exceptional vision birds have. In addition, "a bird's-eye view" from above gives birds an excellent perspective from which to see large landmarks. A bird flying high enough may be able to see evidence of the advance of seasons, such as where ice has melted from lakes. However, at least for some species, this theory is problematic because there would be no way for young birds to know these visual cues prior to their first journey.

Some researchers theorize that birds can sense geomagnetism. According to this theory, the birds sense changes in the earth's magnetic field and its relationship to the earth's surface over some distance and navigate according to those changes.

Since approximately 80 percent of all migratory birds fly at night, many scientists believe that birds use the stars as celestial cues to location, much the same way humans have used them for navigation. By knowing the configuration and placement of certain stars and constellations and knowing how they move across the sky, a bird flying at night can use the stars to fly in the direction it wants to go.

The most likely scenario is that different bird species use different ways to orient or navigate during migration. Each species probably uses one or more of these methods, and the birds may rely primarily on one method and use the others only if necessary. Our uncertainty as to the precise methods used by migratory birds is well put by Illinois bird researcher Sam Robbins:

> It is well known that large numbers of birds, after traveling hundreds of miles, flying mostly at night, succeed in reaching the exact location where they spent the previous summer. What is not well known

is the type of guidance mechanism birds use in migration. Visual images? Auditory images? Memory? Orientation to the stars? Orientation to the earth's magnetic field? My prediction: scientists, philosophers and poets will still be asking these questions years and years from now.

Compass Use

The class will need one compass per group, ideally the type with a flat, plastic base. The arrow (or red end of needle) always points to magnetic north. Hold the compass level in front of you with the arrow on the base plate pointed in the direction you want to travel. Turn the compass housing so that "North" lines up with the arrow inside the housing. Walk in the direction you want to travel, keeping the arrow lined up with "North" on the compass. The direction you want to travel is your **heading**, and it is measured in degrees. If you would like more information, consider the handbook *Be Expert with Map and Compass* by Bjorn Kjellstrom.

Map out a simple (three- to five-point) orienteering course for the class outside in the schoolyard, if possible. Tie brightly colored ribbons around various markers such as trees, flagpoles, basketball goal posts and the front door of school. It will be best if you cannot see all of these places from the starting point. On each ribbon, hang an index card.

Go through the course yourself. Begin with your back to the starting point and determine the compass heading in degrees of your first landmark. This heading is the direction you want to travel to reach the first landmark. Record this heading so that you can give it to students as they begin the course. Students will begin by turning the compass housing so this heading lines up with the direction of travel arrow. They will then turn their bodies so the magnetic needle lines up with the north sign.

Walk to the first landmark. Next, put your back to that landmark, face the second landmark and take a compass reading. Mark this heading on the index card at the first landmark. This heading will tell students which direction to go next. Continue through the course, writing compass headings on index cards at each landmark. Students will use these headings to locate successive landmarks.

As a way to check that students have reached each landmark, put the letters of a scrambled word, such as "Migration," on the index cards. After you've mapped out the course, go around to each index card and put a letter or two from this word on each card. The students will have to record the letters as they get to each landmark and then unscramble the word at the end.

You may want to place a few "false" landmarks with index cards to make the course more challenging. This will insure that students use compass headings to find the landmarks and not just visual cues.

PROCEDURE

1. Ask students how they know how to get from one place to another. Answers and discussion should include experience (memory), vision, verbal directions from someone else, signs and other landmarks, maps, compasses, etc. Ask them how a bird knows where to fly. Answers may include some of the same ways people find direction, such as memory, vision, landmarks, etc. But what about direction for migration? How does a bird travel to a place it's never been before? Tell the students they are going to take an imaginary migration.
2. Divide the class into five cooperative groups. Demonstrate use of a compass to the class. Give each group a compass and have them practice with each other. Tell them to practice by finding a particular landmark, like a flagpole or basketball goal post, and determining its compass heading (e.g., 224 degrees, 90 degrees, etc.). The groups are responsible for making sure each member understands compass use.
3. Have student groups, one group at a time, complete the course as quickly as possible. Explain that they will be competing with the other groups for the migration time. Give the first compass heading at the starting point. One group member is responsible for reading the compass and orienting the group to the first landmark. Tell them to record the letters of the scrambled word on the index card. Pass the compass to another group member and move the direction indicated to the next landmark.
4. Continue until the end of the course.
5. After the migration, bring students together for a discussion. Ask how escaping slaves made their way north to freedom without a compass. On a star map, ask students to point out the North Star. Relate this star to bird migration at night.
6. Ask students how this orienteering activity relates to bird migration. Discuss the different ways birds determine which way to go when they migrate, including the use of the earth's magnetic field.
7. Ask students to relate how they functioned in cooperative groups.

DISCUSSION

1. In what ways is it easy to navigate like a bird? How is it similar or different than navigating like a person? Would a map have helped? Do you think you

could migrate faster a second time?

2. How does a bird's position in the sky give it an advantage during migration? How would the trip have been easier if they could have "looked down" on their route prior to starting?
3. Ask students to relate their experiences in moving as a cooperative group. Could any one individual have accomplished the migration as quickly?
4. Ask the question: "If you were alone in a boat in the middle of an ocean (you don't know which ocean), would you rather have a compass or a map to find your destination?" (Neither will get you there—you need both. Birds have the equivalent of both!)

ASSESSMENT

1. Students should, in one written paragraph, compare human and bird navigation methods.