

# ANIMAL MAGNETISM



## PLANNING THE EXPLORATION

Many animals often travel great distances for a variety of reasons. Ducks migrate in formation, often to the same nesting places. Whales, butterflies, and turtles are believed to use the earth's magnetic field to orient themselves when migrating. The idea that animals may have internal compasses that enable them to complete the same route time after time is one that scientists have been exploring for a very long time.

Students are required to complete a project on the subject of animals and magnetism that is suitable to be presented to the entire class. How this is accomplished is up to you. Below are some suggestions that you may wish to share with your students. However, introducing them to the subject and letting each student, or each group of students, design their own project would be the ideal. The due date that you assign plus the level of your students will determine the complexity of the projects.

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## BACKGROUND INFORMATION

One way that animals are believed to travel great distances is called directional orientation. This implies the ability to travel in a certain direction without using landmarks of any sort. Scientists believe that animals are able to use the sun, the stars, and the earth's magnetic field as compasses. Birds are the most often used example of this phenomenon. They travel thousands of miles in a particular direction and stop when they have flown a prescribed distance.

Recently, there have been articles written on the monarch butterfly (see [The Washington Post](#), May 5, 1997, among others). One study demonstrated that in conjunction with its own internal clock, the monarch uses the sun as a compass to navigate. Monarchs fly 2400 miles across North America each spring. Such a long passage led scientists to study the circumstances necessary for the monarch to make this journey. Although scientists have purported that the monarchs use the sun as a compass, they have also demonstrated that monarchs are able to continue their journey even when it is cloudy. They believe this is due to an internal backup compass. This study has led to an increased interest in the way in which other animals navigate over long distances.

Animals other than birds that exhibit this ability are turtles, whales, and dolphins. Bees are thought to be influenced by some kind of magnetoreception, as are some types of bacteria. Salmon, sharks, rays, and other fish are also thought to be influenced by the earth's magnetic field either alone or in conjunction with other influences such as magnetite deposits, light, or electricity. It is also thought that some animals are sensitive to polarity: the fish swims in a

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certain direction because the field is becoming stronger or weaker.

Some animals actually have magnetite in their bodies, usually in the skull. This could enable them to carry internally a permanent magnet that acts as a compass when they migrate. The magnetite might align with the earth's magnetic field and stimulate some other receptor so that the animal is aware of the direction and strength of the magnetic field. Some bacteria navigate in this manner. The permanent magnets in these cells act like a compass needle. The bacteria then swim in the direction toward magnetic north (in the northern hemisphere).

A good source for information on magnetoreception is Perspectives on Animal Behavior by Judith Goodenough, Betty McGuire, and Robert Wallace (John Wiley & Sons, 1993, ISBN 0-471-53623-7).

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### FOR YOUR PLANBOOK

**Suggested time:** 1+ hours

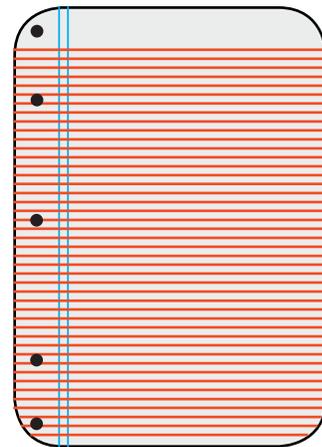
**Gear:** CD-ROM for background information, project supplies

**National Science Content Standards:** A, B, C, D, G.

**Sunshine State Standards Benchmarks:** SC.C.2.3.1, SC.C.2.3.2, SC.C.2.3.3, SC.F.1.3.1, SC.F.1.3.2, SC.F.1.3.7, SC.F.2.3.2, SC.G.1.3.2, SC.H.1.3.1, SC.H.1.3.3, SC.H.1.3.4, SC.H. 2.3.1, SC.H.3.3.7.

**Sunshine State Standards Benchmarks -- Language Arts** (if "Reading and Writing" assessment pieces are completed):

LA.A.1.3.4, LA.A.2.3.1, LA.A.2.3.2, LA.A.2.3.5, LA.A.2.3.6, LA.A.2.3.7, LA.A.2.3.8, LA.B.1.3.1, LA.B.1.3.2, LA.B.1.3.3, LA.C.3.3.3. If computer options are completed: LA.D.2.3.4, LA.D.2.3.5. If Prince of Whales is used: LA.E.1.3.2, LA.E.2.3.1, LA.E.2.3.2, LA.E.2.3.5, LA.E.2.3.6, LA.E.2.3.7.



**Homework:** Students work on their projects at home.

**Assessment:**

Although the method of presentation is up to each student based on his or her learning style, each student or group of students should have a presentation for the whole class. The presentation includes information on how the earth's magnetic field influences animal behavior to indicate that students have determined the relationship between migratory patterns and magnetism. There should be some discussion of an internal compass to show that students can think critically about information on magnetism. Students will demonstrate that

they have designed a project and executed that design.

Regardless of how students decide to present findings, this subject requires research in scientific journals (for example, Nature or Scientific American). Web sites could be explored, as could textbooks, encyclopedias, or the CD-ROM supplied with this book. Explain to students that looking up information on CD-ROM or web sites and printing the information is not creating a report and would be unacceptable.

**Reading and Writing.** Using CD-ROM reference material, web sites, or print media, students explore information about animals

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that use the earth's magnetic field to guide their migratory journeys. There are many outstanding science magazines that can be accessed through school, public, or university libraries. Using LUIS, students can access sources by subject and find out where to obtain them. Expository reading in science is an important skill for students to develop. Information can be presented in ways that encourage analysis of information and the relationship between that information and the subject being studied.

Have students highlight the articles as they read, then summarize, and present a **poster** summarizing the articles. By focusing on

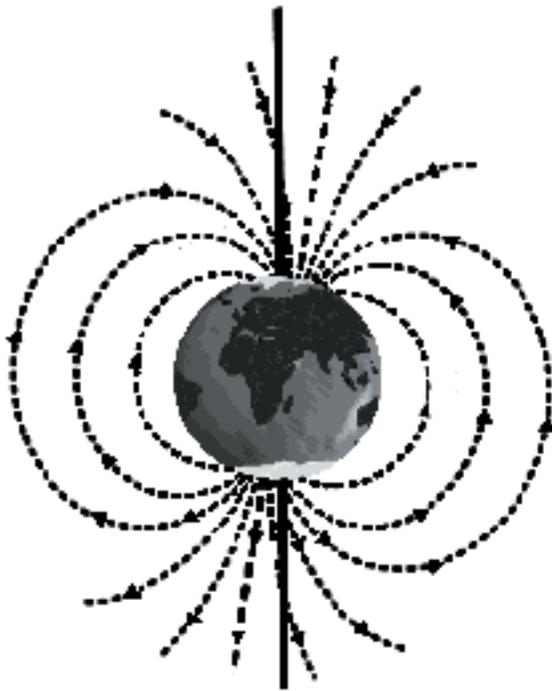
the most important information, students will be forced to identify what is closely related to the study of magnetism. Students will be critical readers as well as demonstrate that they can paraphrase and summarize pertinent information.

Some students could create an **annotated bibliography** for other students to use in the future. In doing so, the student will list sources as well as a short explanation of what can be found at that source. Students will have to distinguish between articles and books that delve into the subject and those that just mention it.

The Prince of Whales by R.L. Fisher (ISBN 0-812-56635-1) is a clever story of a young whale that sets out by himself as he is forced to leave his pod. The pod leaves for their annual migration, and Toby must proceed alone. Although this fantasy does not deal with magnetic reception specifically, students could make the connection. A possible product could be a **diorama, drawing, or a book talk** that states the relationship between Toby's journey and the study of magnetism used to support migratory patterns of whales.

Have students create a **science fiction** or creative writing story that involves an animal that uses the earth's magnetic field to find its way. Stories should include all characteristics of science fiction (tells a good story, deals with human nature, includes science fact, and presents something strange or unusual).

Students can create an **illustrated booklet** for younger children that deals with this subject. This would require that students be able to explain to others how animals use the earth's magnetic field to navigate. Stating explanations and then finding a way to present them to another person will force students to clarify their own ideas.



## *MagLab: Alpha*

**Art.** Have students create a **diorama** of insects, birds, or mammals that use the earth's magnetic field to find direction. The relationship between magnetism and animals' ability to find direction must be clearly displayed plus students will orally explain their project to the rest of the class. Explanations should include why they chose that particular animal, how that animal differs from others, and how it uses either an internal or external compass.

**Computer presentation.** A **multimedia presentation** could include quicktime movies, video clips, a slide show, or any combination of these with text. This could be viewed on individual computers, through a monitor for large-group viewing, or in any other way that the students design themselves. Once they have collected information, students individually or in groups should design a plan for implementing the presentation of the information. Have students present the plan to you for approval, making sure that the task can be completed in the time allotted. Students with computers at home may be more inclined to choose this option.

A computer version of **an annotated bibliography** could be accomplished through a detailed search of web sites that provide information on "animal magnetism." Using the technique of listing the site and then critiquing the site for usefulness, complexity, readability, and accuracy requires that students analyze what they are reading and compare sites. Many websites contain similar information; how well that information is presented (spelling, grammar, etc.) and how sources are presented so that students have confidence that the information is accurate are important skills for middle school students to learn.