Objectives:

- Students will be able to identify a problem.
- Students will be able to explain how research helps to define a problem.
- Students will read, analyze, and explain scientific information.

Time Needed:
1-2 class periods

Materials (for each student or group of students):

- *Natural Inquirer* monograph or article
- Search the Literature Graphic Organizer
- Writing utensil
- Computer (optional)
- Internet (optional)

In this part of the scientific process, a scientist must begin to define the problem or question that will be addressed by the research. Searching the literature to help define the research problem is a critical part of the research process. For an experienced scientist, this part of the research process is often less intensive. He or she already has sufficient experience in the research area to know the previous research on the topic, and already knows some potential future research topics. Young scientists, such as your students, may have many areas of interest that they would like to pursue.

It is helpful to use a graduate student thesis as an example. The student has a general idea of their area of interest. Let’s say that the graduate student is interested in the application of reading in science education. To help the student get to a researchable problem, he or she must begin reading scientific literature on the topic of reading in science education.

The graduate student’s literature review starts broadly and becomes more focused. At some point, the student will identify a problem or question of interest that has not yet been addressed by other scientists. For example, it may become evident that scientists have not correlated an understanding of scientific vocabulary with science achievement in middle school. It may be that this has been done for high school, but the question emerges: “What is the relationship between an understanding of scientific vocabulary and science achievement in seventh grade students?” There is usually a problem behind the research question. The problem behind this question may be grounded in trying to understand part of the problem surrounding middle school students falling behind their global peers in science learning.

As scientists continue in their career, it becomes easier to identify problems. However, it is important for all scientists to stay updated on new research about their topic. This process enables the scientist to avoid duplicating work that has already been done by others, and to add new information to his or her own research projects.

Methods:

Prep

Familiarize yourself with the chosen *Natural Inquirer* monographs or articles. Make copies of the Search the Literature Graphic Organizer.

Note: To limit the number of materials, reuse the *Natural Inquirer* publications selected in Unit 1, Lesson 3.

Prep

Begin class by providing students copies of the chosen *Natural Inquirer* monographs or articles, as well as copies of the Search the Literature Graphic Organizer. Direct students to read only the “Introduction” section of the chosen monographs or articles.
As students read, they should be filling out the graphic organizer to the best of their ability.

After students have finished reading and working on the graphic organizer, hold a class discussion about the importance of gathering information before coming up with a research question. Use the background information provided in this lesson to help guide the discussion. Also ask students to compare and contrast how the scientists came up with the research questions in the “Introduction” sections they read.

If possible, review the *Natural Inquirer* Science Fair Resource page focused on developing testable questions (http://www.naturalinquirer.org/Developing-a-Testable-Question-v-119.html). Share some of the short videos from USDA Forest Service scientists in which they discuss how they develop questions. Ask students to think about how the scientists are similar or different from one another in this process.

As an addition or for homework, ask students to brainstorm three or more science questions that they would be interested in studying. Provide students some examples of questions that you are interested in studying.