# INTRODUCTION

This supplemental life science curriculum is designed to be used in conjunction with other current science curricula and is intended to introduce K-8 students to biological concepts as well as encourage an interest in science in general. The activities in this manual were developed following local, state, and national science standards and benchmarks. Activities may be used to add inquiry-based and problem-solving approaches to the K-8 classroom; they are intended to give students hands-on experience with life science concepts while enhancing critical thinking skills.

## General Layout

This supplemental curriculum begins with a general overview of life science. Subsequent sections of the curriculum are arranged in the hierarchical order of organisms used by taxonomists, beginning with fungi and continuing through invertebrates and vertebrates. The curriculum concludes with sections on the human body and ecology. The design of the curriculum includes a blend of elementary and middle school-level activities, indoor and outdoor activities, and activities that can be done individually, in small groups, or as a class. In many cases, there are suggestions for modifying the activities to different grade levels and to different classroom situations.

## Activity Components

Considerable information is provided for the teacher within each activity. Please note that information that is provided primarily for the teacher's use is printed in English only. Information that the teacher may be distributing to students as well as key content and vocabulary is provided in both English and Spanish. Each section begins with background information, providing an overview of the content material for that section. Each of the activities contained in this supplemental curriculum contains the following components:

*Purpose*

The purpose is an overall description of the activity.

*Materials*

The materials section lists the materials needed to complete the activity.

*Concepts (Also provided in Spanish.)*

The concepts for each activity outline the principles students should learn while doing the activity.

*Grades (Provided in the box at the top of each activity.)*
The grades are a suggestion for what grade levels the activity may be appropriate for. With modifications, many activities can be used with older or younger students.

*Group size (Provided in the box at the top of each activity.)*
The group size is a suggestion for how to break up the class into groups for carrying out this activity and may be adjusted to fit the needs of the class and the teacher.

*Time (Provided in the box at the top of each activity.)*
Each activity includes an estimate of the time it will take to complete the activity. Some of the separate components of the activities can be completed over several days or weeks.

*Safety*
When there are safety issues, they will be listed in this section.

*Vocabulary (Also provided in Spanish.)*
Key words are listed in this section and highlighted throughout the text of the activity.

*In Advance*
This section describes the preparations you will need to make before introducing the activity.

*Procedure*
The procedure section is a step-by-step guide to presenting and conducting the activity.

*Questions to Ask During the Activity (Also provided in Spanish.)*
This section contains several questions to guide students' actions and thinking processes while doing the activity.

*Why It Happens/More on the Topic (Also provided in Spanish.)*
In this section you will find explanations of what is occurring during the activity. This section also might contain additional background information pertaining to the activity.

*Modifications*
The modifications section contains suggestions for how to change the activity for different grade levels or for different situations.

*Extensions*

The extensions section contains ideas for further investigation of the activity's topic.

*References*

The references are the sources of information used in the activity or additional resources that can be used by the teacher.

# *TEACHING TIPS*

The *Proyecto Futuro* Life Science Curriculum is designed to provide educators with an assortment of flexible and stimulating activities. To maximize the effectiveness of the curriculum, review the following tips for integrating cooperative learning techniques, incorporating outdoor learning experiences, and working with all types of students.

## *Cooperative Learning*

Many of the activities in the curriculum rely on cooperative learning principles. It has been shown that students can benefit from working in groups in several ways. Cooperative learning boasts academic achievement, helps students learn how to work together effectively, and increases the self-respect and self-direction of individual students. These improvements are particularly noticeable in students with limited English skills and in low achievers. The following tips will help you make the most of the cooperative learning strategy.

1. When assigning teams, be sure to include a diversity of learners. Consider achievement levels, language skills, learning styles, gender, and ethnicity.

2. Tell students that they should first try to solve problems and ask questions within their group before seeking help from the teacher.

3. Encourage students to work with their group, but also let them know that they are responsible for their own work.

4. Sometimes it will work best to assign roles within each group. Examples of roles include: the materials monitor to gather materials for the activity, a recorder to keep track of data and ideas, a reporter to report the group's findings to the class, a reader to read activity directions, and a time keeper to help the team complete tasks on time.

5. Establish and use a signal to gain attention of the class when necessary.

6. Monitor the groups throughout the activity to make sure they are on task and to assist with questions or problems. Your role should be as facilitator or consultant rather than instructor.

### *Teaching Outdoors*

Teaching and working outdoors presents some different challenges from working indoors. The boundaries are not as clear, there are many background noises, and there are potential hazards. Here are some tips for making your outdoor excursion a safe and positive learning experience.

1. Discuss with students the importance of respecting plants and animals outdoors. Students should not touch unfamiliar plants or animals—they can be harmful. When observing or collecting plants and animals, students should disturb the area as little as possible. Rare plants or animals should not be collected.

2. Explain the activity and rules for working outside as much as possible before leaving the classroom. It will be harder for students to hear and to focus once you are outside.

3. Be sure to bring all the supplies you will need. It will not be easy to return to the classroom during the activity.

4. Once you are outside, identify the boundaries where students will be working. For instance, you may not want students to be out of view or playing on the playground equipment. Also consider directing students to areas where they will have the most success completing the activity.

5. Have a signal that can be used to get the attention of your students. Using a whistle, clapping your hands, or raising your arm are some possibilities.

### *Students with Special Needs*

The activities in this curriculum can be modified to work with a variety of students. Here are some suggestions:

1. Try grouping a bilingual student with a student who has limited English proficiency. Write key words on the chalkboard—sometimes the words from different languages look similar when written. Use pictures, diagrams, and demonstrations to explain instructions when possible.

2. Students with visual impairments may be given oral instructions or a copy of the activity with enlarged print.

3. Students with mobility impairments may be paired with a non-disabled partner when necessary.

4. With gifted students, allow extra time for questions and further investigation.

# TEACHER BACKGROUND INFORMATION

## Scientific Inquiry: Observation and the Scientific Method

In many ways, your students are probably already experts at noticing things that adults pass by. But, while many kids will notice obvious characteristics of objects, observing in the life sciences will require them to hone their **observation** skills. All five senses will be needed: sight, hearing, taste, touch, and smell. And once their observations are made, they will need to analyze and describe them in greater detail. Observation is one of the most important scientific skills and the first step in the **scientific method**.

The scientific method is a set of steps used to systematically test ideas and find answers to questions. The steps of the scientific method include:

1) making an observation
2) formulating a **hypothesis**
3) designing and conducting an **experiment** to test the hypothesis
4) recording the results–often with a table or graph
5) forming a **conclusion**

[A simplified version of the steps in the scientific method for younger students is: Guess, Test, and Tell. Beginning with a problem, students propose a guess. Then they proceed to design a test for proving whether their guess is correct or not. After they have tested their guess, they tell the class their results.]

In some cases, an observation is made by chance. Other times, a scientist seeks more information by doing library research or by talking with others. Regardless of how the observations are made, a question eventually forms and the scientist can begin taking steps to find an answer. Examples of some biological questions are: "At what temperature do lizards become inactive?" "How fast do hummingbirds fly?" "What type of seed does a house finch like?"

The next step is to form a hypothesis based on the original observations. A hypothesis is a statement of a "best guess" answer to a question, or a prediction. It is important that the hypothesis is measurable. For example, after observing the feeder in your back yard, you might hypothesize that house finches like sunflower seeds. While we can't ask a finch which kind of seed it likes best, we can count the number and kind of seeds finches choose to eat at a feeder. So, a more testable hypothesis would be "house finches eat mostly sunflower seeds."

Next, the hypothesis is tested with an experiment. The easiest hypothesis to test is one with a "yes" or "no" answer or result. For example, you could give house finches sunflower seeds and another kind of seed, and then count how many of each kind the finches eat. The results of an experiment should either support or falsify the hypothesis. For example, if 80% of the seeds the house finches ate were sunflower seeds, the hypothesis would be supported in this case.

The experiment might not always provide an answer to the hypothesis, though. Sometimes new questions arise. Frequently one trial of the experiment is not enough. What if you conducted your experiment by observing only one house finch on one day? Would you be able to conclude that house finches eat mostly sunflower seeds? Probably not. But if you were to observe 20 house finches, you might be able to predict that other groups of house finches under the same conditions would also eat mostly sunflower seeds. Each time you conduct your experiment under the same conditions, it is referred to as a **replicate**.

When designing an experiment, it is also important to have a **control**. A control is the "measuring stick" that can be used as a comparison for experiment results. The control for the house finch study is a seed other than the sunflower seeds. If the only choice the house finch had was sunflower seeds (no control) it would be impossible to know whether house finches prefer sunflower seeds or just ate them when nothing else was available.

The **experimental variable** is the portion of the experiment that is used to test the hypothesis. It is important that there be only one difference between the variable and the control. If there is more than one variable, it's difficult to tell which variable caused the results. For example, if you provided the finches with three different kinds of seeds—small sunflower seeds, large sunflower seeds, and large thistle seeds—and they chose the small sunflower seeds, it would not be clear whether the size of the seed was more important than the kind of seed. It is important to make sure that all the conditions between the control and variable are equal except the one attribute being tested.

One of the most important features of a scientific experiment is that results can be duplicated each time the experiment is conducted. This helps ensure that the results are not just one-time, chance events. For instance, in the house finch experiment, it would be important to conduct the experiment under the same weather conditions, at the same time of year, in the same type of habitat, using the same type of feeders. The results of the experiment should be similar with each trial before a final conclusion can be made.

Finally, it is tempting to conclude that a hypothesis is "proven true" when the experiment results confirm the hypothesis. In science, however, results either support or falsify the hypothesis rather than prove it. It is always assumed that future experiments could change our ideas about what is true and what is false. For example, the same house finch experiment could be conducted during a different season of the year and we could find that house finches only prefer sunflower seeds in the summer, but not in the winter. This new data would only partially support the original hypothesis.

Often students are disappointed when their hypothesis is not supported by experiment results. But there are no wrong or right answers when an experiment is designed and conducted well. Some of the most important discoveries occur when an experiment generates more questions rather than supporting the original hypothesis. In fact, some of the most interesting scientific breakthroughs have been purely accidental! Emphasizing this point with students will give them the freedom to think more creatively, to ask questions, and to experiment without fear of "failure."

### *Record Keeping and Journals*

Scientists often keep records of their observations. Sometimes the records are in the form of numbers in a table, drawings in the margins of a page, or written thoughts about their research topic. Record keeping in all of its forms allows a scientist to discover patterns and make connections between separate observations. Keeping a science journal can do the same for your students. Journal writing during and after activities will help sharpen their writing, reading, and communication skills, and will help them discover patterns and connections as they work their way through the activities. Many of the activities in this curriculum provide a Student Activity Sheet for students to record their observations and data. Encourage your students to keep an ongoing journal where they can enter their thoughts on the activities they are doing in the classroom and how they apply to their "real world" experiences.