

Real Science-4-kids

# Biology

Level I

TEACHER'S MANUAL

Dr. Rebecca W. Keller





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*Illustrations:*

All illustrations were created by the author except the following which were purchased from Art Today: Chapter 1: 1.1 frog, spider, 1.3 dog, tiger, snake, rabbit, cat, jellyfish, bee, bird, butterfly, evergreen, fungi 1.4 dog, cat, frog, bee, 1.5, lion, tiger, bobcat, housecat; Chapter 4: 4.1 cow, Chapter 5: 5.2 cherries, rose, pinecone; Chapter 6: 6.1 fish, 6.2 microscope; Chapter 8: 8.1 adult frog, tadpoles, 8.3 tadpole, 8.4 tadpole, juvenile frog, 8.5 adult frog, Azure Dart frog; Chapter 9: 9.1 butterfly, caterpillar, pupa, 9.3 caterpillar photos, 9.4, Australian birdwing butterfly; Chapter 10: 10.1 earth, 10.3 tiger, deer, mouse, fungi.

*To Kimblery, Christopher, Katy, Lorien, Sam, Ben  
 and Lee*

## A Note from the Author

This curriculum is designed to give students both solid science information and hands-on experimentation. This level is geared towards second to fifth grades and much of the information in the text is very different from what is taught at this grade level in other textbooks. However, I feel that students beginning in the second grade can grasp most of the concepts presented here. This is a *real* science text and so scientific terms are used throughout. It is not important at this time for the students to master the terminology, but it is important that they be exposed to the real terms used to describe science.

Each chapter has two parts: a reading part and an experimental part. In the teacher's text, an estimate is given for the time needed to complete each chapter. It is not important that both the reading portion and the experimental portion be concluded in a single sitting. It may be better to split these into two separate days depending on the interest level of the child, and the energy level of the teacher. Also, questions not addressed in the teacher's manual may arise, and extra time might be necessary to further investigate any additional questions the student may have before proceeding with the experimental section.

Each experiment has been designed as a *real* science experiment and not just a demonstration. The experiments are meant to engage the students in an actual scientific investigation. It is my hope that the students will eventually begin to think of their own experiments in order to test their own ideas.

Enjoy!

*Rebecca W. Keller*

## Getting Started

The easiest way to follow this curriculum is to have all of the materials needed for each lesson ready before you begin. A small shelf or cupboard or even a plastic bin be dedicated to holding most of the necessary chemicals and equipment. Those items that need to be fresh are indicated at the beginning of each lesson. The following is a partial list of equipment required for the experiments:

marking pens for writing on glass, wax paper etc.

several small jars (baby food jars)

two large glass jars (pickle or mayonnaise jar)

measuring spoons

eye droppers

distilled water

absorbent paper (white)

food coloring

timer

rubber bands

Several experiments require living things. Some of the living things can be found in the backyard or local environment. Some living things may also be purchased from a local pet store. If necessary, all of the living things can be purchased from internet sources. Carolina Biological Supply Company is a recommended source and all experiments involving living things have been conducted using products from this company. Four other biological supply companies are also listed, but their products have not been tested.

Carolina Biological Supply Co. [www.carolina.com](http://www.carolina.com)

Berkshire Biological [www.berkshirebio.com](http://www.berkshirebio.com)

Blue Spruce Biological Supply [www.bluebio.com](http://www.bluebio.com)

Tobin's Lab [www.tobinslab.com](http://www.tobinslab.com)

## Keeping a Laboratory Notebook

A laboratory notebook is essential for the experimental scientist. In this notebook, the results for all of the experiment are kept, together with comments and any additional information. For this curriculum, you should record your experimental observations and conclusions directly in the pages in the laboratory notebook- just like real scientists.

The experimental section for each chapter is pre-written. All experiments written in laboratory notebooks have certain essential parts. First, a descriptive but short *Title* is written at the top of the page together with the *Date* the experiment is performed. Below the title, an *Objective* and *Hypothesis* are written. The *Objective* is a short statement that tells something about why the experiment is to be performed, and the *Hypothesis* tells what is the predicted outcome. Next, a *Materials List* should be written. The materials should be gathered *before* the experiment is started. Following the materials list, the *Experiment* is written. The sequence of steps for the experiment is written beforehand and any changes are noted during the experiment. All of the details of the experiment are written in this section. All information that is thought to be of some importance is included. For example, if you are to measure out 1 cup of water for an experiment, but you actually measured 1 and  $\frac{1}{4}$  cup, this should be recorded. It is hard sometimes to predict how small variations in an experiment will affect the outcome and it is easier to track a problem if all of the information is recorded.

The next section is the *Results* section. Here the scientist records the experimental observations. It is extremely important that the scientist be honest about what is observed. For example if the experimental instructions say that a solution will turn yellow, but your solution turned blue - record blue. You may have done the experiment incorrectly or you might have discovered a new and interesting result, but either way it is very important that your observations be honestly recorded.

Finally, the *Conclusions* should be written. Here you will explain what the observations may mean. You should try to write only valid conclusions. It is important to learn to think about what the data actually show and what cannot be concluded from the experiment.

## Laboratory Safety

Most of these experiments use household items. However, some items such as iodine are extremely poisonous. Extra care should be taken while working with all chemicals in this series of experiments. Outlined below are some general laboratory precautions that should be applied to the home laboratory:

Never put things in your mouth except if the experiment tells you to. This means that food items should not be eaten unless it is part of the experiment.

If available use safety glasses while using glass objects or strong chemicals such as bleach.

Wash hands after handling all chemicals.

Use adult supervision while working with knives or any step requiring a stove.

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