



Biology for the Logic Stage {3rd Edition} Sample Packet

The following sample packet includes the first two weeks of the third edition of *Biology for the Logic Stage* materials. You will see:

- ✓ The Teacher Guide (*beginning on p. 3*)
- ✓ The Student Guide (*beginning on p. 38*)

You can get more information and purchase this award-winning program here:

🔗 <https://elementalscience.com/collections/biology-for-the-logic-stage>

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A Peek Inside the Logic Stage Teacher Guide

The teacher guide is your go-to resource for guiding your students through science!

1. Weekly Topic

Explore one main topic throughout the week. The students will learn about the subject by doing experiments, reading from visually appealing encyclopedias, and writing what they have learned. You can assign them optional activities as well.

2. Two Scheduling Options

Provide guidance to the students with these two grid-style scheduling options. There are 2-day-a-week and 5-day-a-week schedules. These schedules break down the essential work and the optional activities into manageable chunks so that you can help them proceed with confidence.

3. Student Assignment Sheet

See the core of our logic stage programs—the student assignment sheets. In the teacher guide, you will find snippets of this sheet so that you have a clear picture of the tasks that have been assigned to the students for the week.

4. Notes

Get key information and further explanations of the topics when necessary. These notes will assist you as you teach science to your students.

DO Science

5. Experiment Information

Know what you need to know about the weekly experiment, which will coordinate with the topic. This section includes the

28

Week 1: Cells **1**

2-Days-a-Week Schedule

	Day 1	Day 2
Do	☐ Do the "What do plant cells look like?" experiment	☐ (Choose one of the Want More Activities)
Read	☐ Define cell and mitosis ☐ (Read one or all of the additional reading assignments)	☐ Read the reading assignment and discuss what was read ☐ (Work on the Five Kingdoms Memory Work)
Write	☐ Fill out the experiment sheet ☐ Enter the dates onto the date sheets	☐ Color and label the "Plant & Animal Cell" sketch ☐ Prepare an outline or narrative summary

2

5-Days-a-Week Schedule

	Day 1	Day 2	Day 3	Day 4	Day 5
Do	☐ Do the "What do plant cells look like?" experiment		☐ (Choose one of the Want More Activities)		☐ (Choose one of the Want More Activities)
Read	☐ (Read one or all of the additional reading assignments)	☐ Read the reading assignment and discuss what was read	☐ Define cell and mitosis	☐ (Read one or all of the additional reading assignments)	☐ (Work on the Five Kingdoms Memory Work)
Write	☐ Fill out the experiment sheet	☐ Write an outline or list of facts	☐ Color and label the "Plant & Animal Cell" sketch	☐ (Prepare a report)	☐ Enter the dates onto the date sheets

Supplies I Need for the Week

- ✓ Microscope, Slide, Onion skin, Celery stalk
- ✓ (Optional) Animal cell slide, Plant cell slide, Microscope, Margarine container, Jell-O, Grape, Materials for organelles

Biology Unit 1: Biological Building Blocks ~ Week 1: Cells

29

Teacher Notes

Student Assignment Sheet Week 1 (SG p. 18)

Do—Hands-on Science Activities

☐ **Experiment:** What do plant cells look like? (SG pp. 20-21)

Materials

✓ Microscope, 2 Slides, 2 Coverslips Onion skin, Celery stalk

(Note—If you have never used a microscope before, please ask the teacher to demonstrate how to use a microscope before beginning this experiment.)

☐ **Want More Activities:** See your teacher for additional microscope work and directions for a Jell-O cell.

Hands-on Science Notes

3

✦ **Microscope Access** – If you don't own a microscope, first have the students look at the slivers of celery and onion skin with a magnifying glass. Have them draw what they see in the 100x box, relabeling it "magnifying glass." Then, have them look at the following website and draw what the plant cells look like from there in the 400x box.

☐ www4.usps.edu/biology/courses/biolab/Lab03a.htm

✦ **How to Make a Slide** – For more information on how to make a slide, see the following:

☐ <https://elementalscience.com/blogs/science-activities/how-to-make-a-microscope-slide>

Experiment Information

✦ **Introduction** – (in the student materials) All living things are made up of tiny building blocks called cells. Cells carry out the necessary functions of life for the animal and plant. The best way to see these cells is by using a microscope. In this experiment, you will use a microscope to view the basic building blocks of celery and onion.

✦ **Procedure** – (in the student materials)

1. Make a wet mount slide of the onion skin.

How to make a wet mount slide

- a. Collect a thin slice of the sample and place it on the slide. (Make sure the sample is very thin or else the cover slip will wobble and you won't get a very good view of the sample.)
- b. Place one drop of water over the sample. (Make sure not to use too much water or else the cover slip will float away and again you won't be able to see the sample.)
- c. Place the cover slip at a 45 degree angle, with one edge touching the water, and let go. The slide is ready to be viewed.

5

2. Look at the slide under the microscope on low power (100x) and then on high power (400x). Draw what you see for each.

Biology Unit 1: Biological Building Blocks ~ Week 1: Cells

introduction and procedure, which are also included in the student materials. It also lists the expected results, an explanation, and ideas to take the hands-on science fun further.

6. Want More Activities

Add a bit of fun with these optional research projects and hands-on science project ideas. These relate to and reinforce what the students are learning about the week's subject.

READ Science

7. Discussion Questions with Answers

Find discussion questions with the answers. You have the tools necessary to lead an effective discussion time without having to read the selection.

8. Vocabulary

Enhance your students' science vocabulary by introducing words that are relevant to the weekly topic.

WRITE Science

9. Sketch Answers

Know how and where the students should label the pre-drawn sketches with the completed images.

10. Unit Tests

Test what your students have learned over the unit with the end-of-unit tests. These are only in the teacher guide, so you can choose to use them orally, written, or not at all.

30

3. Nest, make a wet mount slide of the celery stalk. Look at the slide under the microscope on low power (100x) and then on high power (400x). Draw what you see for each.

Results—The students should be able to see plant cells in both the onion skin and the celery stalk at both the magnification powers. Their drawings for the 400x should include the cell shape (i.e., like bricks on a building). Their drawings for the 100x should look similar to the onion skin, except in color.

Explanation—This experiment was designed to be a simple introduction into using a microscope, making slides, and viewing cells.

Take it Further—Purchase a set of slides to view. View all the slides in your set that have to do with cells. Examine the difference and the similarities.

Want More Activities

➤ **Microscope Work**—Purchase a prepared slide of an animal or plant cell and have the students look at it under the microscope. They could then complete the microscope worksheet found on p. 261 of the app.

➤ **Jello Cell**—Have the students make a Jello cell. Use a margarine container for the cell membrane, Jello for cytoplasm, and a cherry for the nucleus and use your imagination for materials for the remaining organelles.

Read—Gathering Information

❑ **Main Reading Assignment:** *Urban Science Encyclopedia* pp. 250-251 (Plant Cells), pp. 298-299 (Animal Cells)

Optional Research Readings

❑ **The Parts of a Cell and what they do (including organelles):** *UIDS* pp. 238-240

❑ **Cells:** *DKEN* pp. 20-21

❑ **Vocabulary:** cell, mitosis (SG p. 16)

❑ **Memory Work:** This week, work on memorizing the Five Kingdoms and their Basic Characteristics. (SG p. 249)

1. **Monerans**—Microscopic organisms that have a simple, single cell. (Example: Bacteria)

2. **Protists**—A variety of complex, but mainly single-celled organisms. (Example: Algae)

3. **Fungi**—Organisms that absorb food and reproduce by making spores. (Example: Mold)

4. **Plants**—Living things that have many cells and most carry out photosynthesis. (Example: Tree)

5. **Animals**—Organisms made up of many cells and live by eating food. (Example: Human)

Informational Notes

➤ **Mitosis**—The subject of mitosis will be covered again in the sketch for week 21.

Discussion Questions for Reading Assignments

Plant Cells, pp. 250-251

1. What are three of the basic parts of a plant cell and what does each do? (Answers should be: Three parts of the plant cell are _____, _____, and _____.)

Biology Unit 2: Biological Building Blocks ~ Week 3: Cells

31

Write—Notebooking Assignments

❑ **Writing Assignment**—Write a list of facts, an outline, or a report. (SG pp. 22-23)

❑ **Sketch:** Plant and Animal Cells (SG p. 19)

➤ Label the following on the Plant Cell = cell wall, cell membrane, cytoplasm, vacuole, nucleus, chloroplasts

➤ Label the following on the Animal Cell = nucleus, nucleolus, mitochondria, vacuole, endoplasmic reticulum, ribosome, cell membrane, lysosome, cytoplasm

Biology Unit 2: Biological Building Blocks ~ Week 3: Cells

Informational Notes

1. Explain how cells come together to form organs. (Individual cells group together to form tissues. Several different types of tissues then group together to form organs. The organs group together to form systems and the systems group together to form a living individual called an organism.)

Vocabulary

❑ **Cell**—A tiny unit of living matter, the basic building block of all life.

❑ **Mitosis**—The division of a cell nucleus to produce two identical cells.

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Biology Unit 2: Biological Building Blocks ~ Week 3: Cells

32

Write—Notebooking Assignments (continued)

❑ **Dates to Enter** (SG pp. 11-14)

➤ 1595—Zacharias Janssen built the first microscope.

➤ 1665—The cell was first discovered and named by Robert Hooke.

➤ 1839—Cell theory was developed by Matthias Schleiden and Theodor Schwann.

Sketch Assignment Answers

Plant Cell

Labels: cell wall, cytoplasm, vacuole, chloroplasts, nucleus, cell membrane

Animal Cell

Labels: nucleus, nucleolus, mitochondria, vacuole, cell membrane, cytoplasm, lysosome, ribosomes

Biology Unit 2: Biological Building Blocks ~ Week 3: Cells

33

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Biology Unit 2: Biological Building Blocks ~ Week 3: Cells

34

Biological Building Blocks Unit Test

A. Bundles of DNA that can be found in the cell's nucleus, they work together to tell an organism how to develop.

B. A tiny unit of living matter, the basic building block of all life.

C. A process whereby energy passes along a chain of living things.

D. A way of identifying or grouping living things.

E. The division of a cell nucleus to produce two identical cells.

F. A set of instructions that tell your body how to develop found on the chromosomes.

G. The highest category into which living things are classified.

H. The study of relationships between organisms and their environment.

I. A group of living things that live together in the wild.

J. A collection of living things and their environment.

K. Any material that is taken in by a living thing to sustain life.

L. The natural home of a species.

M. A collection of interconnected food chains.

True or False

1. _____ Plant cells are identical to animal cells in all ways.

2. _____ Individual cells group together to form tissues, different types of tissues group together to form organs, organs group together to form systems, and the systems group together to form a living individual called an organism.

Biology Unit 2: Biological Building Blocks ~ Unit Test

A Peek Inside the Logic Stage Student Guide

Harness the benefits of notebooking, and promote independent learning with the student guide.

1. Student Assignment Sheet

See the core of our logic stage programs—the student assignment sheets. This sheet has all the assignments for the week with checkboxes for the student to use.

2. Pre-drawn Sketch

Color the pre-drawn sketch relating to the week's topic. Then have the students label it with the information on the Student Assignment Sheet.

3. Experiment Sheet

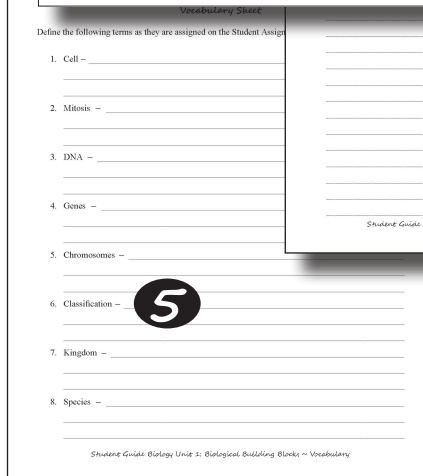
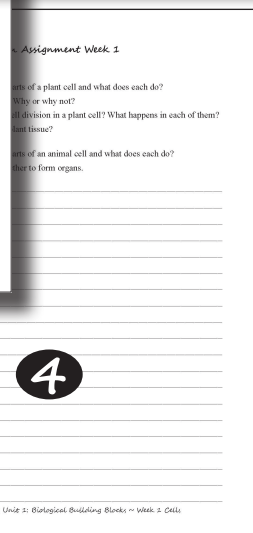
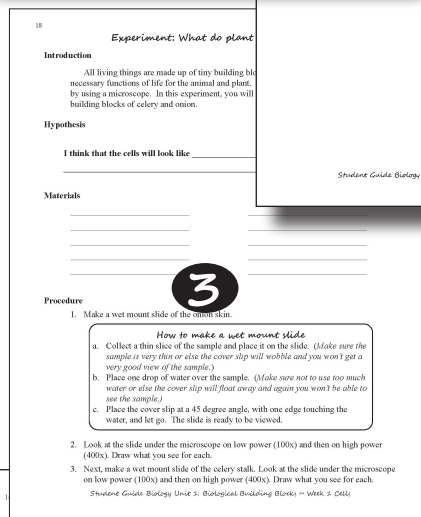
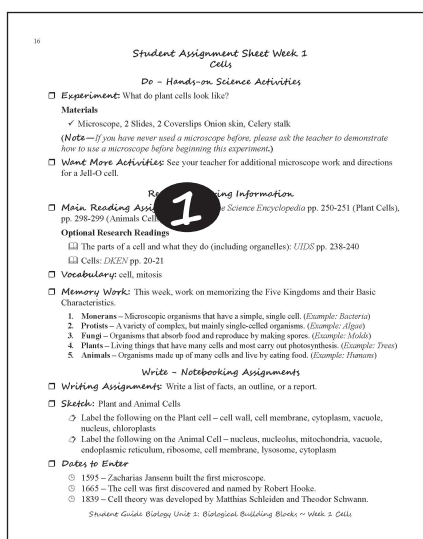
Do an experiment related to the topic for the week. The Experiment Sheet contains the introduction and the procedure for the experiment. It also has space for the students to record the hypothesis, materials, observation, results, and conclusion.

4. Written Assignment

Know the questions for discussion time, and have plenty of space for the students to write either a list of facts, an outline, or summary.

5. Unit Glossary

Keep all the unit vocabulary in one place. The glossary gives space for the students to write the definitions for each vocabulary word.



Biology for the Logic Stage

Teacher Guide

In a Nutshell

Students will study cells, ecology, plants, animals, and the human body in the following ways:

- ✓ Doing **hands-on science** through experiments and activities.
- ✓ Reading **scientific information** from visually appealing encyclopedias.
- ✓ Writing down what they have learned and seen using **organized notebooking**.

See pp. 21-22 for a list of the topics explored in this program.

What You Need

Besides this guide, you will need:

1. **The student materials**—You will need to purchase the *Biology for the Logic Stage Student Guide*. Get a glimpse of the student guide (SG) on p. 9.
2. **The two required spines:**
 -  *The Usborne Science Encyclopedia (Usborne, 2015 Edition)*
 -  *The Kingfisher Science Encyclopedia (Kingfisher, 2024 Edition)*

You can also purchase one or more of the optional research encyclopedias, which you can see listed in the introduction. Get links to these books here:

 <https://elementalscience.com/blogs/resources/bls>

3. **The experiment supplies**—See a full list starting on p. 23 or save yourself the time and purchase the *Biology for the Logic Stage Experiment Kit*.

How It Works

Each week, you and your middle school student will:

-  **Do** the weekly experiments by following the procedure, recording your observations and results, and drawing conclusions about what you saw.
-  **Read** the assigned pages and discuss the information with you using the included questions.
-  **Write** down what the students have learned in a way that is appropriate for their skills and label a related sketch.

You can also add in the memory work and additional science activities if you want to dig deeper into a topic. For a more detailed explanation of the components in each lesson, we highly recommend checking out the peek inside this program on pp. 7-8, reading the introduction starting on pp. 10-15, or seeing how to structure your week on pp. 16-19. Otherwise, the first lesson begins on p. 28.

Biology for the Logic Stage Teacher Guide

Table of Contents

<i>Quick Start Guide</i>	3
<i>Introduction to the Third Edition</i>	10
<i>How to Structure Your Week</i>	16
<i>Book List</i>	19
<i>{Optional} Experiment Equipment</i>	19
<i>Microscope Information</i>	20
<i>Sequence of Study</i>	21
<i>Materials Listed by Week</i>	23
<i>Unit 1: Biological Building Blocks</i>	26
Overview of Study	26
Week 1: Cells	28
Week 2: DNA and Genetics	33
Week 3: Classification	37
Week 4: Nutrient Cycles	41
Week 5: Basic Ecology	47
Unit Test	51
Unit Test Answers	55
<i>Unit 2: Plants</i>	58
Overview of Study	58
Week 6: Fungi	60
Week 7: Simple Plants	64
Week 8: Flowerless Plants	68
Week 9: Flowering Plants	72
Week 10: Seeds and Fruits	76
Week 11: Trees	80
Unit Test	84
Unit Test Answers	88
<i>Unit 3: Invertebrates</i>	92
Overview of Study	92
Week 12: Annelids, Platyhelminthes, Nematodes	94
Week 13: Cnidarians and Echinoderms	98
Week 14: Mollusks	102

Week 15: Crustaceans (Arthropods)	106
Week 16: Insects (Arthropods)	110
Unit Test	114
Unit Test Answers	118
<i>Unit 4: Vertebrates</i>	122
Overview of Study	122
Week 17: Fish	124
Week 18: Amphibians	128
Week 19: Reptiles	132
Week 20: Birds	136
Week 21: Mammals	140
Unit Test	144
Unit Test Answers	148
<i>Unit 5: Animal Overview</i>	150
Overview of Study	150
Week 22: Animal Research Project	152
Week 23: Migration	156
Week 24: Animal Defenses	160
Week 25: Feeding and Nutrition	164
Unit Test	168
Unit Test Answers	171
<i>Unit 6: The Human Body</i>	174
Overview of Study	174
Week 26: Integumentary System	178
Week 27: Skeletal System	182
Week 28: Muscular System	186
Week 29: Nervous System	190
Week 30: Endocrine System (Hormones)	194
Mid-Unit Test	198
Mid-Unit Test Answers	203
Week 31: Circulatory System	206
Week 32: Respiratory System	210
Week 33: Digestive System	214
Week 34: Urinary System	218
Week 35: Immune System	222
End of Unit Test	226
End of Unit Test Answers	230
<i>Year-end Review</i>	234
Year-end Test Information and Answers	234
Year-end Test	236

<i>Appendix</i>	245
Dates to Enter Master List	247
The Scientific Method Explained	250
The Science Fair Project Presentation Board	251
Reading Assignments for Younger Students	252
Punnett Square Worksheet	255
<i>Templates</i>	257
Two Days a Week Schedule Template	259
Five Days a Week Schedule Template	260
Microscope Worksheet	261
Dissection Report	262

Introduction to the Third Edition

It has been more than 14 years since the first edition of *Biology for the Logic Stage* was released. With each edition, the format has been refined, but the method has always been based on the same three keys to teaching science:

1. Read about science.
2. Do, or rather play with, science.
3. Write about science.

In this guide are the tools you need to teach science using the Classic Method found in *Success in Science: A Manual for Excellence in Science Education*, where we state that the middle school student is “a bucket full of unorganized information that needs to be filed away and stored in a cabinet.” The goals of science instruction at the logic level are to begin to train the students’ brains to think analytically about the facts of science, to familiarize the students with the basics of the scientific method through inquiry-based techniques, and to continue to feed the students with information about the world around them.

Biology for the Logic Stage integrates the above goals using the Classic Method of middle school science instruction as suggested in our book. This method is loosely based on the ideas for classical science education that are laid out in *The Well-Trained Mind: A Guide to Classical Education at Home* by Jessie Wise and Susan Wise Bauer.

The Student Guide

Biology for the Logic Stage seeks to encourage independence in the students as they learn about the field of biology. To do this, we have created a student guide which is sold separately.

The *Biology for the Logic Stage Student Guide* contains all the student assignment sheets, pre-drawn sketches ready for labeling, experiment pages, and blank report pages. The guide also includes blank date sheets and all the sheets they will need for the science fair project. In short, the student guide contains all the pages the students will need in a bound book. This guide is essential to complete this program.

Now that you understand that, let’s take a closer look at what you will find in your teacher guide.

The Teacher Guide

This guide includes the weekly student assignment sheets, all the sketches pre-labeled for you, and discussion questions to help you guide the discussion time. This guide also contains information for each experiment, including the expected results and an explanation of those results. There is a list of additional activities that you can choose to assign for each week. Finally, this guide includes possible schedules to use as you guide the students through *Biology for the Logic Stage*.

Weekly Schedule Options

Biology for the Logic Stage should take up to three hours per week. You and the students can

choose whether to complete the work over five days or over two days. Each week, there are two scheduling options to use as you lead them through this program. These are guides, so feel free to change the order to better fit the needs of the students.

We also recommend that you let the students be in charge of choosing how many days they would like to do science because this will help foster independence in their schoolwork. You will find two blank scheduling templates for you to use in the appendix of this guide on pp. 259–260.

Do—Hands-on Science Activities

Experiments

Each week will revolve around a weekly topic. The students will be assigned an experiment that poses a question related to the topic. Each of these experiments will walk the students through the scientific method (see the appendix p. 250 for a brief explanation of the scientific method).

The shaded box contains the hands-on science information from the Student Assignment Sheet. After that, you will find several sections for the experiments:

- ☐ Introduction and Procedure—Both sections are copies of what can be found in the student materials. (*If needed, you find troubleshooting tips in this section, too.*)
- ☐ Results—This section shares the expected results.
- ☐ Explanation—This section provides an explanation of the expected results.
- ☐ Take It Further—This section has ideas you can use to expand on the experiment.

The Science Fair Project

A science fair project is scheduled for the students during Unit 5. *Janice VanCleave's A+ Science Fair Projects* and *Janice VanCleave's A+ Projects in Biology: Winning Experiments for Science Fairs and Extra Credit* are excellent resources for choosing project topics within the field of biology. If you would like the students to take part in a science fair, you can call your local school system to see if it allows homeschooled students to take part, or you can get information on national science fairs from them. Otherwise, the students can present their projects in front of a group of friends and family.

{Optional} Want More Activities

Each week, the “Do” section includes a list of additional activities. ***These activities are totally optional.*** The “Want More” activities explore the science on a deeper level by researching specific topics or through additional projects. The students do not have this information in their guides, so it is up to you whether to assign these. Several of the “Want More” activities require materials that would need to be purchased from a lab science supply company. The following companies are good places to look for these materials:

1. **Home Science Tools** (<http://www.hometrainingtools.com>)
2. **Nasco Science Supplies** (<http://www.enasco.com/science>)
3. **Carolina Biological Supply Company** (<http://www.carolina.com>)

You will need to purchase a frog dissection kit for Week 19 from one of these companies. Additionally, here is a list of optional dissection kits you can get from a lab supply company for the optional activities:

- ✦ **Week 12:** Earthworm dissection kit
- ✦ **Week 13:** Starfish dissection kit
- ✦ **Week 20:** Owl pellet dissection kit
- ✦ **Week 29:** Sheep's brain dissection kit
- ✦ **Week 31:** Sheep's heart dissection kit
- ✦ **Week 34:** Sheep's kidney dissection kit

Read—Gathering Information

Main Reading Assignments

Each week, the students will be assigned pages to read from one of the spine texts, either in *The Usborne Science Encyclopedia* or in the *Kingfisher Science Encyclopedia*. Have them read the assigned pages and discuss what they have read with you.

We have included a list of possible discussion questions from the main reading assignment along with the answers. These are meant to aid you in leading the discussion time with the students. You should encourage them to answer in complete sentences because this will help them organize their thoughts for the writing assignment.

The discussion questions are also in the student materials, so the students can be prepared. However, if they are already writing outlines or lists of facts, you do not need to have them write out the answers. There is plenty of writing required in this program already.

Vocabulary

Throughout the year, the students will be assigned weekly vocabulary. They will need to write out the definitions for each word on the Unit Vocabulary Sheet found in the student guide during the week that they are assigned. You may want to have the students also make flash cards to help them work on memorizing the words.

Memory Work

This year, the students will also memorize several lists of facts that correspond to each unit. There is a complete listing of the vocabulary words and memory work for each unit on the unit overview sheet in this guide, along with a glossary and a list of the memory work in the student guide.

Write—Notebooking Assignments

Writing Assignments

After discussing the weekly reading, you have three options for the students' written assignments:

- ❑ **Option 1: Have the students write an outline from the spine text**—A typical fifth grader completing this program should be expected to write a two level outline for the two page spread assigned for the week. This outline should include the main point from each

paragraph on the page along with one to three supporting points.

- ❑ **Option 2: Have the students write a narrative summary from the spine text**—A typical fifth grader completing this program should be expected to write a two- to four-paragraph summary (or six to ten sentences) about what they have read in the spine text.
- ❑ **Option 3: Have the students write both an outline and a written report**—First, have the students read the assigned pages in the spine text. Then, have them write a two level outline or list of seven to nine facts for the two page spread. Next have the students do some additional reading on the topic from one or more of the additional research assignments. Each topic will have pages assigned from the reference books listed below for their research.
 - 📖 *The Usborne Science Encyclopedia, 2015 Edition (USE)*—This resource is appropriate for most fifth and sixth graders. It is also used as a spine text for this study.
 - 📖 *The Kingfisher Science Encyclopedia, 2017 Edition (KSE)*—This resource is a slightly more advanced reference work than *The Usborne Science Encyclopedia*. It is also used as a spine text for this study.
 - 📖 *DK Encyclopedia of Nature, 2007 Edition (DKEN)*—This resource is appropriate for most fifth through seventh graders. It is on the same level as *The Kingfisher Science Encyclopedia*, but it's difficult to find as it goes in and out of print.
 - 📖 *Usborne Illustrated Dictionary of Science, 2012 Edition (UIDS)*—This resource is approaching the high school level.
 - 📖 *DK Eyewitness Book: Human Body, 2014 Edition (DK HB)*—This resource is only for the human body study and also approaches the high school level.

Once the students complete the additional research reading, have them write a report of two to four paragraphs detailing what they have learned from their research reading.

Keep in mind that your writing goal for middle school students is to have them write something (narrative summary, outline, or list of facts) every day you teach school, either in science or in another subject. The writing option you choose for this curriculum will depend on the writing the students are already doing in their other subjects.

Sketch

Each week, the students will be assigned a sketch to complete and label. The student materials contain an unlabeled sketch for them to use. They will color the sketch, label it, and give it a title according to the directions on the Student Assignment Sheet. The information they need will be in their reading, but the sketch is not always identical to the pictures found in the encyclopedia. As a result, these sketch assignments should make the student think. This guide contains a completed sketch for you to use when checking their work.

Dates to Enter

Each week, the dates of important discoveries within the topic are given on the student assignment sheet. The students will enter these dates onto one of their date sheets. The date sheets are divided into the four time periods as laid out in *The Well-Trained Mind* by Susan Wise Bauer and

Jessie Wise (Ancients, Medieval-Early Renaissance, Late Renaissance-Early Modern, and Modern). Completed date sheets are available in the appendix of this guide, on pp. 247-249.

Unit Tests

The students will complete a lot of work each week that will help you assess what they are learning, so testing is not absolutely necessary. However, we have included end-of-unit tests you can use with the students if you feel the need to do so. The tests and their answers are included after the material for each unit in this guide, except Unit 6. Unit 6 has two tests, one mid-unit test that covers the first five weeks and one end-of-unit test that covers the last five weeks. You can choose to give the tests orally or copy them for the students to fill out.

Additional Information

Helpful Articles

Our goal is to provide you with the information you need to be successful in your quest to educate your students in the sciences at home. This is the main reason we share tips and tools for homeschool science education on our blog, podcast, and YouTube channel.

As you prepare to guide your students through this program, you may find the following articles helpful:

- 🔊 *The 3 Keys to Teaching Science*—This video explains how we believe science should be taught.
 <https://youtu.be/yOVbBNENkOU>
- 🔊 *Classical Science Curriculum for the Logic Stage Student*—This podcast details the goals of logic stage science and shows how the classical educator can use the tools they have at their disposal to reach these goals.
 <https://elementalscience.com/blogs/podcast/114>
- 🔊 *Scientific Demonstrations vs. Experiments*—This article shares information about these two types of scientific tests and points out how to employ scientific demonstrations or experiments in your homeschool.
 <https://elementalscience.com/blogs/news/89905795-scientific-demonstrations-or-experiments>
- 🔊 *A Simple Explanation of the Scientific Method*—This article details the steps of the scientific method, along with why it is so important to teach.
 <https://elementalscience.com/blogs/news/simple-explanation-of-the-scientific-method/>

Safety Advisory

Some experiments in this book use either boiling water or open flames. We recommend the students use safety glasses and protective gear with each experiment to prevent accidents. Do not allow the students to perform any of the experiments marked “⚠️ CAUTION” on their own.

Additional Resources

You will find quick links to the web-based activities suggested in this guide, along with

Biology for the Logic Stage ~ Introduction

several helpful downloads, at the following website:

 <https://elementalscience.com/blogs/resources/bls>

A Quick Note from the Author

If you find this program contains too much work, please tailor it to the needs of your students. As the author and publisher of this curriculum, I encourage you to contact me with questions or problems that you might have concerning *Biology for the Logic Stage* at support@elementalscience.com. I will be more than happy to answer them as soon as I am able. I hope that you and your students enjoy *Biology for the Logic Stage*!

~ Paige Hudson

How to Structure Your Week

Two Days a Week

A typical two-day schedule will take one to one-and-a-half hours per day. Here is a breakdown of how a normal two-days-a-week schedule would work using the first week as an example:

✦ **Day 1: Define the vocabulary, do the experiment, complete the experiment sheet, and record the dates.**

Begin Day 1 by having the students do the “What do plant cells look like?” experiment. Have them read the introduction and then perform the experiment using the directions provided. Next, have them draw what they see, discuss their results with you, and then write a conclusion for their experiment. Finish the day by having them look up and define “cell” and “mitosis” using the glossary in the student guide and add the dates to their date sheets.

✦ **Day 2: Read the assigned pages and discuss together, prepare an outline or narrative summary, and complete the sketch.**

Begin by having the students read pp. 250–251 and 298–299 of the *Usborne Science Encyclopedia*. Then, using the questions provided, discuss what they have read. Have them complete the sketch using the directions on the Student Assignment Sheet. Finally, have them write an outline or narrative summary. Here is what that could look like:

Sample one-level outline of the spine text for Week 1

- I. Cells are the basic building blocks of life.
- II. Animal cells have a thin outer membrane and have specialized structures inside called organelles.
- III. Plant cells differ from animal cells because they have a tough outer membrane and contain chloroplasts.
- IV. Cells can work together.
- V. Cells reproduce through a process called mitosis.

Sample Narrative Summary from the spine text only for Week 1

Cells are the basic building blocks of all living things. They are controlled by genes called DNA. Cells can work together in a multicellular organism. They reproduce through a process called mitosis.

Animal cells are usually soft and flexible. They have a thin outer membrane and are filled with a jelly-like substance called cytoplasm. The cytoplasm contains small structures called organelles. The organelles carry out many functions in the cell, such as making proteins.

Plant cells differ from animal cells in several ways. They have an additional outer membrane, which is tough. A plant cell is rigid because of pressure from the inside. Also, plant cells contain chloroplasts, which are necessary for photosynthesis.

Five Days a Week

A typical five-day schedule will take thirty to forty-five minutes per day. Here is a breakdown of how a normal five-days-a-week schedule would work using the first week as an example:

✚ **Day 1: Do the experiment, and complete the experiment sheet.**

Begin Day 1 by having the students do the “What do plant cells look like?” experiment. Have them read the introduction and then perform the experiment using the directions provided. Next, have them draw what they see, discuss their results with you, and then write a conclusion for their experiment.

✚ **Day 2: Read the assigned pages, discuss together, and write an outline or list of facts.**

Begin by having the students read pp. 250-251 and 298-299 of the *Usborne Science Encyclopedia*. Discuss what they have read using the provided questions. Then, have the students write a two- to three-level outline and complete the sketch using the directions on the Student Assignment Sheet. Here’s a sample list of facts:

Sample list of facts from the spine text for Week 1

1. Cells are the basic building blocks of life.
2. Animal cells have a thin outer membrane and have specialized structures inside called organelles.
3. Plant cells differ from animal cells because they have a tough outer membrane and contain chloroplasts.
4. Cells can work together.
5. Cells reproduce through a process called mitosis.

✚ **Day 3: Record the dates, define the vocabulary, and complete the sketch.**

Begin by having the students look up and define “cell” and “mitosis” using the glossary in their guide. Have them add the dates to their date sheets. Then have them complete the sketch using the directions on the Student Assignment Sheet.

✚ **Day 4: Read from the additional reading assignments, and prepare a written report.**

Begin by having the students read pp. 238-240 about the parts of the cell in *The Usborne Illustrated Dictionary of Science*. Then, have them use their outline or list of facts along with what they have just read to write a two- to four-paragraph summary of what they have learned. Here’s a sample of what that summary could look like:

Sample Written Report for Week 1

Cells are the basic building blocks of life from which every living thing is made. There are many cells that work together to keep an individual alive. Cells perform all the processes necessary for life, such as absorbing food and minerals, removing waste, and producing energy. They are constantly making copies of themselves, through mitosis, so that the new cells can replace ones that die.

Animal cells have a nucleus and cell membrane. Inside, they are filled with a substance called cytoplasm, which contains a number of organelles. Organelles each have different functions, such as the mitochondria that convert simple substances into energy that can be used by the cell. Animal cells work together to form tissues,

tissues work together to form organs, organs work together to form systems, and systems work together to form an individual.

Plant cells are a little larger than animal cells, but they also contain several unique structures. The first is the cell wall, which is a rigid outer layer made of cellulose. The second is chloroplasts, which contain chlorophyll, a chemical that helps produce food for a plant. Plant cells also have a sap-filled vacuole, chromoplasts, a cell membrane, and a nucleus. Plant cells work together to form three main plant tissues.

✚ **Day 5: Complete one of the “Want More” activities.**

Have the students look at some preprepared slides that came with your microscope, or make a replica of a cell with Jell-O. You could also have them read about a scientist from the field of biology.

How to Include Younger Students

We recognize that many homeschool families have a range of different student ages. If you wish to have all the students studying the topic of biology, you have two options for the elementary students when using this program with the middle school students:

✚ **Option 1: Have the younger students use *Biology for the Grammar Stage*.**

This option is appropriate if the younger students are in K through second grade and/or if your older student is ready for some independence. You can rearrange the units in *Biology for the Logic Stage* so that all the students will remain on similar topics. If you choose to do this, have the older student complete Unit 1, Units 3 through 5, then Unit 6, and finish with Unit 2.

✚ **Option 2: Have the younger students use *Biology for the Logic Stage along with the older students*.**

This option is best if the younger students are in third or fourth grade and/or if the older student is not ready to work independently. You need to adjust the workload for the younger students. Here are some suggestions on how to do that:

- ✓ Have them watch and observe the experiments, but do not require the younger students to predict the outcome of the experiment (hypothesis).
- ✓ Add some picture books from the library for each of the topics.
- ✓ Read the reading assignments to them, and have them narrate them back to you.
- ✓ Let the younger students color the sketches, and then tell them how to label them.

As for the reading assignments, you may find that the spines scheduled are too much for the younger students. If so, you can use the following books instead:

📖 *DK Encyclopedia of Animals*

📖 *DK First Human Body Encyclopedia*

A chart coordinating these resources in the appendix of this guide on pp. 252-254.

Book List

The following books were used when planning this study. Get links for these on the program resource page found here:

 <https://elementalscience.com/blogs/resources/bls>

Encyclopedias for Reading Assignments

The following books are the main spines of this program. You will need to purchase both to complete the reading assignments scheduled in this program. (**Note**—*The editions noted here are the most current editions. However, the past two editions of each of these spines will also work.*)

 *The Usborne Science Encyclopedia, 2015 Edition* (USE)

 *The Kingfisher Science Encyclopedia, 2017 Edition* (KSE)

{Optional} References for Reports

The following encyclopedias are scheduled for additional reference reading. They are optional.

 *Usborne Illustrated Dictionary of Science, 2012 Edition* (UIDS)—This resource is approaching the high school level.

 *DK Encyclopedia of Nature, 2007 Edition* (DKEN)—This resource is good for most fifth through seventh graders. It is on the same level as *The Kingfisher Science Encyclopedia*, but it can be difficult to find because it goes in and out of print.

 *DK Eyewitness Book: Human Body, 2014 Edition* (DK HB)—This resource is only for the human body study and also approaches the high school level. (**Caution**—*This book is graphic and not for sensitive children.*)

{Optional} Experiment Equipment

If you would like to create a more lab-like experience for the students this year, you can use equipment that is more commonly found in the laboratory setting. Here's a list of material that you can substitute:

- ✓ **Jar**—Use a beaker or Erlenmeyer flask that is at between 750 and 1000 mL.
- ✓ **Cup**—Use a beaker or Erlenmeyer flask that is at between 200 and 500 mL.
- ✓ **Bottle**—Use an Erlenmeyer flask that is between 250 and 1000 mL.
- ✓ **Small cup**—Use a small beaker (50 mL) or test tube.
- ✓ **Eye dropper**—Use a pipette.

You can use the glass or plastic version of each of the above.

Microscope Information

What to Look for When Buying a Microscope

When purchasing a microscope for homeschool use, look for the following specs:

- ✦ A compound monocular microscope.
- ✦ A microscope with 4x, 10x, and 40x objective lenses at a minimum (**Note**—*The eyepiece should also give 10x magnification, which then will allow you to look at an object at 40x, 100x, and 400x magnification.*)
- ✦ A microscope with separate coarse and fine adjustment knobs.
- ✦ A good light source. (**Note**—*The best light sources are an LED or cool fluorescent bulb. Do not get one with mirror illumination because they are difficult to adjust.*)

You can purchase a good-quality microscope at Lab Essentials, Inc. (www.labessentials.com), Children's Microscopes (www.childrensmicroscopes.com), or Home School Science Tools (www.hometrainingtools.com). We also suggest purchasing some blank slides so that you can create your own. For more information on purchasing a microscope, listen to the following podcast:

 <https://elementalscience.com/blogs/podcast/27>

How to Use a Microscope

To learn how to use a microscope before you have to teach it, see these articles:

 <http://www.microscope-microscope.org/basic/how-to-use-a-microscope.htm>

 <https://elementalscience.com/blogs/science-activities/how-to-make-a-microscope-slide>

Experiments that Use a Microscope

The following weeks will require the use of a microscope to complete the experiment:

- ✦ **Week 1:** What do plant cells look like?
- ✦ **Week 7:** Can I grow algae?
- ✦ **Week 8:** Observation of a fern
- ✦ **Week 9:** Dissection of a flower

What if You Can't Get a Microscope?

If you cannot afford to get a microscope, don't worry. The students can still complete the experiments scheduled in this program. There are links to websites where you can view the assigned slides included in the teacher notes. You can also Google the sample name along with "microscope" to find additional pictures.

Additional Activities that Will Use a Microscope

The following weeks have optional "Want More" activities requiring the use of a microscope:

- ✦ **Week 1** (Any type of cells, including plant cells)
- ✦ **Week 13** (Water hydra)
- ✦ **Week 27** (Hair and skin)
- ✦ **Week 28** (Bone cells)
- ✦ **Week 29** (Muscle cells)
- ✦ **Week 32** (Red blood cells)

Sequence of Study

Introductory & Plant Units (11 weeks)

Unit 1: Biological Building Blocks (5 Weeks)

- ✓ Cells
- ✓ DNA and Genetics
- ✓ Classification
- ✓ Nutrient Cycles
- ✓ Ecology

Unit 2: Plants (6 Weeks)

- ✓ Fungi
- ✓ Simple Plants
- ✓ Flowerless Plants
- ✓ Flowering Plants
- ✓ Seeds and Fruit
- ✓ Trees

Animal Units (14 weeks)

Unit 3: Invertebrates (5 Weeks)

- ✓ Annelids/Platyhelminthes/Nematodes
- ✓ Cnidarians/Echinoderms
- ✓ Mollusks
- ✓ Arthropods
- ✓ Insects

Unit 4: Vertebrates (5 Weeks)

- ✓ Fish
- ✓ Amphibians
- ✓ Reptiles
- ✓ Birds
- ✓ Mammals

Unit 5: Animal Overview (4 weeks)

- ✓ Science Fair Project
- ✓ Migration
- ✓ Animal Behavior
- ✓ Animal Partnerships
- ✓ Adaptations and Defenses

Human Body Unit (10 weeks)

Unit 6: Human Body (10 Weeks)

- ✓ Integumentary System
- ✓ Skeletal System
- ✓ Muscular System
- ✓ Nervous System
- ✓ Endocrine System (optional Reproductive System)
- ✓ Circulatory System
- ✓ Respiratory System
- ✓ Digestive System
- ✓ Urinary System
- ✓ Immune System

Review (1 week)

Materials Listed by Week

Introductory & Plant Units

Unit 1: Biological Building Blocks

Week	Materials
1	Microscope, Slides, Cover slips, Onion skin, Celery stalk
2	Banana Slices, Dish soap, Salt, Ice-cold isopropyl alcohol (70% or higher), Zipper-style plastic bag, Coffee filter, Funnel, Wooden coffee stirrer, Test tube (or clear glass jar)
3	Leaf for identification
4	<i>There are no materials needed for this week.</i>
5	Air dry clay, Shoebox, Paint, Construction paper

Unit 2: Plants

Week	Materials
6	Bread, Plastic bag, Water
7	2 Fresh spinach leaves, Baking soda, Liquid dish soap, 2 Clear plastic cups, Water
8	Fern (with spores if possible), Magnifying glass, Microscope, Slide and cover slip
9	Flower (either lily, poppy or tulip), Razor blade, Magnifying glass, Microscope, Slide, Cover slip
10	2 Cups, Soil, Bean seed, Corn seed, Marker
11	Ruler, String, Measuring tape, Partner, Broadleaf tree

Animal Units

Unit 3: Invertebrates

Week	Materials
12	Small plastic soda bottle, Sand, Loam, Crushed leaves, Worms, Water, Paper towel, Rubber band
13	Plastic bowl, Porous material (such as a sponge, brick or charcoal), Liquid bluing, Water, Salt, Measuring spoon
14	Snail, 2 Lettuce leaves, Paper towel, Caffeinated drink (preferably black coffee), Empty milk jug, Rubber band
15	3 Cups, 3 Uncooked shrimp shells, Bleach, Vinegar, Salt, Water, Gloves
16	1 Apple, 2 Glass jars

Unit 4: Vertebrates

<i>Week</i>	<i>Materials</i>
17	1 Large clear glass jar or bowl, 3 Small balloons, 3 Small marbles, Ruler, Water
18	1 Frog dissection kit, 1 Preserved frog
19	Clothespin, Blindfold, 5 Pieces of bread with different edible spreads on them (such as garlic, cinnamon/ sugar, butter, peanut butter, and plain), 5 Plates
20	Chopsticks, Tweezers, Pliers, Eye dropper, Sugar, Water, Gummy worms, Peanuts, Seeds, Raisins, Plates
21	Felt, Cotton balls, Water, 1 Large cup, 4 Small cups, Instant thermometer, Foil

Unit 5: Animal Overview

<i>Week</i>	<i>Materials</i>
22-25	Science Fair Project supplies will vary depending on the project the students choose to do.

Human Body Unit

Unit 6: Human Body

<i>Week</i>	<i>Materials</i>
26	Pennies (10-30), 2 Pieces of hair (at least 5 inches long), Several heavy books, Pencil, Tape, Glass, Bleach, Glove, Water
27	3 Bones, Vinegar, Glass, 3 Plastic bags, Hammer
28	Yourself, Door frame
29	Yardstick, Partner
30	Watch with a second hand, Partner
31	Water, Cornstarch, Flour, Sugar, Red food coloring, Glass
32	Watch with a second hand
33	3 Cups oatmeal (cooked according to package directions and cooled), Water, Bowl, Pantyhose
34	2 Glasses, Coffee filter, Food coloring, Flour or sand, Water, Rubber band
35	Several friends, Several different colors of glitter

Biology: Unit 1

Biological Building
Blocks

Unit 1: Biological Building Blocks

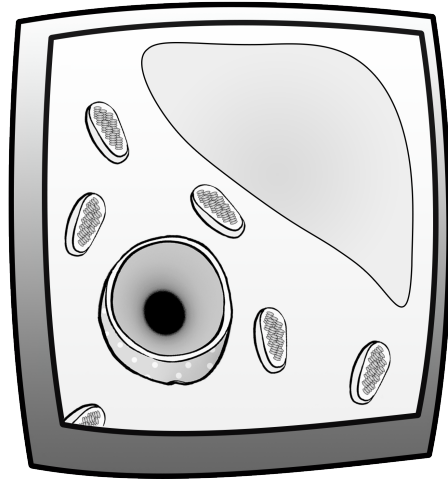
Overview of Study

Books Scheduled

- 📖 *The Usborne Science Encyclopedia* (USE)
- 📖 *The Kingfisher Science Encyclopedia* (KSE)

{Optional Encyclopedias}

- 📖 *DK Encyclopedia of Nature* (DKEN)
- 📖 *Usborne Illustrated Dictionary of Science* (UIDS)



Sequence of Study

- 📅 **Week 1:** Cells
- 📅 **Week 2:** DNA and Genetics
- 📅 **Week 3:** Classification
- 📅 **Week 4:** Nutrient Cycles
- 📅 **Week 5:** Ecology

Memory Work for the Unit

Five Kingdoms and their Basic Characteristics

1. **Monerans** – Microscopic organisms that have a simple, single cell. (*Example: Bacteria*)
2. **Protists** – A variety of complex, but mainly single-celled organisms. (*Example: Algae*)
3. **Fungi** – Organisms that absorb food and reproduce by making spores. (*Example: Molds*)
4. **Plants** – Living things that have many cells and most carry out photosynthesis. (*Example: Trees*)
5. **Animals** – Organisms made up of many cells and live by eating food. (*Example: Humans*)

Divisions of Life

1. Kingdom
2. Phylum
3. Class
4. Order
5. Family
6. Genus
7. Species

(The following mnemonic can help you as you work on memorizing these: **King Phillip Can Only Find his Green Shoes**)

Materials by Week

Week	Materials
1	Microscope, Slides, Cover slips, Onion skin, Celery stalk
2	Banana Slices, Dish soap, Salt, Ice-cold isopropyl alcohol (70% or higher), Zipper-style plastic bag, Coffee filter, Funnel, Wooden coffee stirrer, Test tube (or clear glass jar)
3	Leaf for identification
4	<i>There are no materials needed for this week.</i>
5	Air dry clay, Shoebox, Paint, Construction paper

Vocabulary for the Unit

1. **Cell** – A tiny unit of living matter, the basic building block of all life.
2. **Mitosis** – The division of a cell nucleus to produce two identical cells.
3. **Genes** – A set of instructions that tell your body how to develop; found on the chromosomes.
4. **Chromosomes** – Bundles of DNA that can be found in the cell's nucleus; they work together to tell an organism how to develop.
5. **Classification** – A way of identifying or grouping living things.
6. **Kingdom** – The highest category into which living things are classified.
7. **Species** – A group of living things that can breed together in the wild.
8. **Nutrient** – Any material that is taken in by a living thing to sustain life.
9. **Food chain** – A process whereby energy passes along a chain of living things.
10. **Food web** – A collection of interconnected food chains.
11. **Ecosystem** – A collection of living things and their environment.
12. **Ecology** – The study of relationships between living things and their environment.
13. **Habitat** – The natural home of a species.

Week 1: Cells

2-Days-a-Week Schedule

	Day 1	Day 2
Do	☐ Do the “What do plant cells look like?” experiment	☐ {Choose one of the Want More Activities}
Read	☐ Define cell and mitosis ☐ {Read one or all of the additional reading assignments}	☐ Read the reading assignment and discuss what was read ☐ {Work on the Five Kingdoms Memory Work}
Write	☐ Fill out the experiment sheet ☐ Enter the dates onto the date sheets	☐ Color and label the “Plant & Animal Cell” sketch ☐ Prepare an outline or narrative summary

5-Days-a-Week Schedule

	Day 1	Day 2	Day 3	Day 4	Day 5
Do	☐ Do the “What do plant cells look like?” experiment		☐ {Choose one of the Want More Activities}		☐ {Choose one of the Want More Activities}
Read	☐ {Read one or all of the additional reading assignments}	☐ Read the reading assignment and discuss what was read	☐ Define cell and mitosis	☐ {Read one or all of the additional reading assignments}	☐ {Work on the Five Kingdoms Memory Work}
Write	☐ Fill out the experiment sheet	☐ Write an outline or list of facts	☐ Color and label the “Plant & Animal Cell” sketch	☐ {Prepare a report}	☐ Enter the dates onto the date sheets

Supplies I Need for the Week

- ✓ Microscope, Slide, Onion skin, Celery stalk
- ✓ {Optional} Animal cell slide, Plant cell slide, Microscope, Margarine container, Jell-O, Grape, Materials for organelles

Teacher Notes

Student Assignment Sheet Week 1 (SG p. 18)

Do—Hands-on Science Activities

- ☐ **Experiment:** What do plant cells look like? (SG pp. 20-21)

Materials

✓ Microscope, 2 Slides, 2 Coverslips Onion skin, Celery stalk

(Note—*If you have never used a microscope before, please ask the teacher to demonstrate how to use a microscope before beginning this experiment.***)**

- ☐ **Want More Activities:** See your teacher for additional microscope work and directions for a Jell-O cell.

Hands-on Science Notes

- ✦ **Microscope Access** – If you don't own a microscope, first have the students look at the slivers of celery and onion skin with a magnifying glass. Have them draw what they see in the 100x box, relabeling it “magnifying glass.” Then, have them look at the following website and draw what the plant cells look like from there in the 400x box.

 <https://www4.uwsp.edu/biology/courses/botlab/Lab03a.htm>

- ✦ **How to Make a Slide** – For more information on how to make a slide, see the following:

 <https://elementalscience.com/blogs/science-activities/how-to-make-a-microscope-slide>

Experiment Information

- ✦ **Introduction** – *(in the student materials)* All living things are made up of tiny building blocks called cells. Cells carry out the necessary functions of life for the animal and plant. The best way to see these cells is by using a microscope. In this experiment, you will use a microscope to view the basic building blocks of celery and onion.
- ✦ **Procedure** – *(in the student materials)*
1. Make a wet mount slide of the onion skin.

How to make a wet mount slide

- a. Collect a thin slice of the sample and place it on the slide. *(Make sure the sample is very thin or else the cover slip will wobble and you won't get a very good view of the sample.)*
- b. Place one drop of water over the sample. *(Make sure not to use too much water or else the cover slip will float away and again you won't be able to see the sample.)*
- c. Place the cover slip at a 45 degree angle, with one edge touching the water, and let go. The slide is ready to be viewed.

2. Look at the slide under the microscope on low power (100x) and then on high power (400x). Draw what you see for each.

3. Next, make a wet mount slide of the celery stalk. Look at the slide under the microscope on low power (100x) and then on high power (400x). Draw what you see for each.

- ☞ **Results** – The students should be able to see plant cells in both the onion skin and the celery sliver at both the magnification powers. Their drawing for the 100x should include the cell shape (i.e., like bricks on a building). Their drawings for the 400x should include the cell wall, cell membrane, and the nucleus of each of the cells. The celery stalk will look similar to the onion skin, except in color.
- ☞ **Explanation** – This experiment was designed to be a simple introduction into using a microscope, making slides, and viewing cells.
- ☞ **Take if Further** – Purchase a set of slides to view. View all the slides in your set that have to do with cells. Examine the difference and the similarities.

Want More Activities

- ☞ **Microscope Work** – Purchase a prepared slide of an animal or plant cell and have the students look at it under the microscope. Students should then complete the microscope worksheet found on p. 261 of the appendix.
- ☞ **Jello Cell** – Have the students make a jello replica of a cell. Use a margarine container for the cell membrane, jello for cytoplasm, a grape for the nucleus and use your imagination for materials for the remaining organelles.

Read—Gathering Information

- ☐ **Main Reading Assignment:** *Usborne Science Encyclopedia* pp. 250-251 (Plant Cells), pp. 298-299 (Animals Cells)

Optional Research Readings

- 📖 The parts of a cell and what they do (including organelles): *UIDS* pp. 238-240
- 📖 Cells: *DKEN* pp. 20-21

- ☐ **Vocabulary:** cell, mitosis (SG p. 16)
- ☐ **Memory Work:** This week, work on memorizing the Five Kingdoms and their Basic Characteristics. (SG p. 249)
 1. **Monerans** – Microscopic organisms that have a simple, single cell. (*Example: Bacteria*)
 2. **Protists** – A variety of complex, but mainly single-celled organisms. (*Example: Algae*)
 3. **Fungi** – Organisms that absorb food and reproduce by making spores. (*Example: Molds*)
 4. **Plants** – Living things that have many cells and most carry out photosynthesis. (*Example: Trees*)
 5. **Animals** – Organisms made up of many cells and live by eating food. (*Example: Humans*)

Informational Notes

- ☞ **Mitosis** – The subject of mitosis will be covered again in the sketch for week 21.

Discussion Questions for Reading Assignments

Plant Cells, pp. 250-251

1. What are three of the basic parts of a plant cell and what does each do? (*Answers should be: Three parts of the plant cell are _____, _____,*

and _____. The _____ does _____, and so on.

Answers should come from the following information: Cell wall – made of cellulose and helps the cell keep its shape, Cell membrane – found just under the cell wall, Vacuoles – fluid-filled sacs that store liquids such as sap for the plant cell, Nucleus – controls the activity in the cell, Cytoplasm – gel-like fluid surrounding the nucleus that contains the organelles of a cell, Chloroplasts – chlorophyll, which makes food for the plant and gives it a green color.)

2. Are all plant cells the same? (No) Why or why not? (Plant cells have different shapes and structures depending on the job they have in the cell.)
3. What are the two stages of cell division in a plant cell? (The two stages of cell division in a plant are called mitosis and cytokinesis.) What happens in each of them? (During mitosis, the nucleus divides, creating two parts; each part becomes a new nucleus. During cytokinesis, a cell plate forms along the dividing line and a new cell wall builds up along the plate.)
4. What are the three types of plant tissue? (The three types of plant tissue are dermal tissue, ground tissue, and vascular tissue.)

Animal Cells, pp. 298-299

1. What are three of the basic parts of an animal cell and what does each do? (Answers should be: Three parts of the animal cell are _____, _____, and _____. The _____ does _____, and so on.
Answers should come from the following information: Cell membrane – holds the contents of the cell together and acts as a barrier, Nucleus – controls the activity in the cell, Cytoplasm – gel-like fluid surrounding the nucleus that contains the organelles of a cell, Golgi complex – stores and distributes substances, Nucleolus – make the ingredients for ribosomes, Mitochondria – converts simple substances into energy, Vacuoles – storage sacs for liquids or fats, Endoplasmic reticulum – used to transport materials in the cell, Centrioles – play a role in cell division, Ribosomes – help to make proteins, Lysosomes – destroy invading bacteria.)
2. Explain how cells come together to form organs. (Individual cells group together to form tissues. Several different types of tissues then group together to form organs. The organs group together to form systems and the systems group together to form a living individual called an organism.)

Vocabulary

- ☐ **Cell** – A tiny unit of living matter, the basic building block of all life.
- ☐ **Mitosis** – The division of a cell nucleus to produce two identical cells.

Write—Notebooking Assignments

- ☐ **Writing Assignments:** Write a list of facts, an outline, or a report. (SG pp. 22-23)
- ☐ **Sketch:** Plant and Animal Cells (SG p. 19)
 -  Label the following on the Plant cell – cell wall, cell membrane, cytoplasm, vacuole, nucleus, chloroplasts
 -  Label the following on the Animal Cell – nucleus, nucleolus, mitochondria, vacuole, endoplasmic reticulum, ribosome, cell membrane, lysosome, cytoplasm

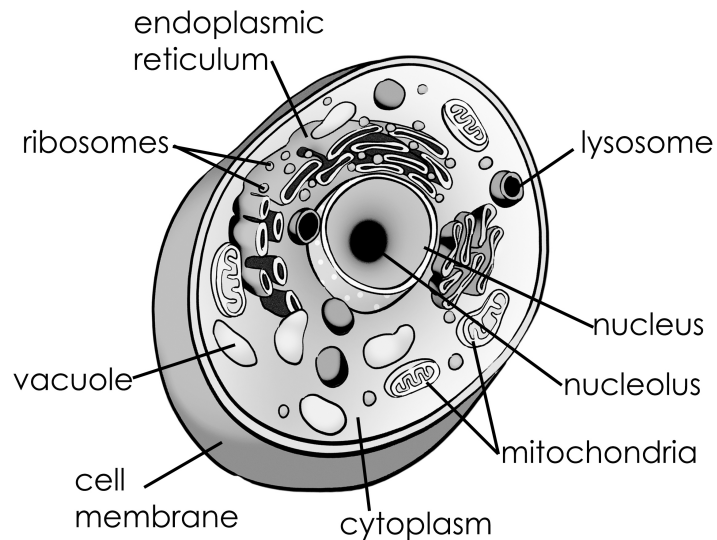
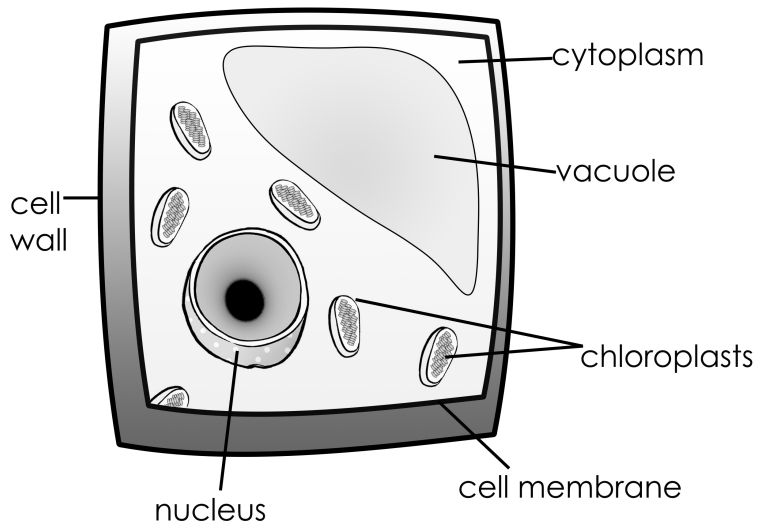
Write—Notebooking Assignments (continued)

☐ Dates to Enter (SG pp. 11-14)

- ⌚ 1595 – Zacharias Jansenn built the first microscope.
- ⌚ 1665 – The cell was first discovered and named by Robert Hooke.
- ⌚ 1839 – Cell theory was developed by Matthias Schleiden and Theodor Schwann.

Sketch Assignment Answers

Plant Cell



Animal Cell

Week 2: DNA and Genetics

2-Days-a-Week Schedule

	Day 1	Day 2
Do	☐ Do the “DNA Extraction” experiment	☐ {Choose one of the Want More Activities}
Read	☐ Define genes and chromosomes ☐ {Read one or all of the additional reading assignments}	☐ Read the reading assignment and discuss what was read ☐ {Work on the Five Kingdoms Memory Work}
Write	☐ Fill out the experiment sheet ☐ Enter the dates onto the date sheets	☐ Color and label the “DNA to Chromosomes” sketch ☐ Prepare an outline or narrative summary

5-Days-a-Week Schedule

	Day 1	Day 2	Day 3	Day 4	Day 5
Do	☐ Do the “DNA Extraction” experiment		☐ {Choose one of the Want More Activities}		☐ {Choose one of the Want More Activities}
Read	☐ {Read one or all of the additional reading assignments}	☐ Read the reading assignment and discuss what was read	☐ Define genes and chromosomes	☐ {Read one or all of the additional reading assignments}	☐ {Work on the Five Kingdoms Memory Work}
Write	☐ Fill out the experiment sheet	☐ Write an outline or list of facts	☐ Color and label the “DNA to Chromosomes” sketch	☐ {Prepare a report}	☐ Enter the dates onto the date sheets

Supplies I Need for the Week

- ✓ Banana Slices, Dish soap, Salt, Ice-cold isopropyl alcohol (70% or higher), Zipper-style plastic bag, Coffee filter, Funnel, Wooden coffee stirrer, Test tube (or clear glass)
- ✓ {Optional} 2 different colors of LEGO bricks with 6 studs (at least 6 bricks of each color), 2 different colors of LEGO bricks with 4 studs (at least 6 bricks of each color)

Teacher Notes

Student Assignment Sheet Week 2 (SG p. 24)

Do—Hands-on Science Activities

❑ **Experiment:** DNA Extraction (SG pp. 26-27)

Materials

- ✓ Banana Slices, Dish soap, Salt, Ice-cold isopropyl alcohol (70% or higher), Zipper-style plastic bag, Coffee filter, Funnel, Wooden coffee stirrer, Test tube (or clear glass)

❑ **Want More Activities:** See your teacher for directions on a DNA tower and optional Punnett Square worksheet.

Experiment Information

- ☞ **Introduction** – (*in the student materials*) DNA is the stuff that tells our cells what to do and how to look. It resides in the nucleus of a cell, so as you can imagine, it is quite tiny. In fact, you normally need a very powerful microscope to see DNA for yourself. In today's experiment, you are going to try to extract DNA and cause it to join up into a mass you can see.
- ☞ **Procedure** – (*in the student materials*)
 1. Make the extraction solution by measuring out ½ cup of water (120 mL). Add 2 tablespoons (35 mL) of liquid dish soap and 1 teaspoon (5 grams) of salt. Mix well.
 2. Add several slices of banana to the baggie – about a third of a banana will do. Using your hands, squish the outside of the baggie to mash up the banana. Then, add 1 to 2 tablespoons (15 to 30 mL) of extraction solution. Keep squishing for about a minute or so to make sure that some of the DNA is released into the solution. (**Note**—*If you have time, you can let the mixture sit for ten to fifteen minutes so that even more DNA is released.*)
 3. Line the funnel with the coffee filter and place the funnel in the test tube. Then, pour the contents of the baggie into the lined funnel and gently squeeze the liquid into the test tube. You want the tube to be about a quarter to a third full.
 4. Slowly pour 2 to 3 tablespoons (30 to 45 mL) of the ice-cold alcohol into the test tube, so that you create a layer of alcohol resting on your fruit layer.
 5. Watch what happens. Use the wooden coffee stirrer to gently stir the solution and collect any of the material you can see.
- ☞ **Troubleshooting** – Be sure the alcohol is ice-cold. The colder it is, the more DNA will precipitate out.
- ☞ **Results** – The students should see something that looks like cotton fluff in the test tube after the alcohol is added.
- ☞ **Explanation** – When the students mashed up the fruit, they were breaking down some of the cell walls mechanically. This caused part of the DNA to head out into the solution. Then, the extraction solution that the students added chemically broke down the cell walls of the fruit. When the students added the alcohol, the DNA in the solution precipitated out, or joined back up together to form a solid. The cotton fluff the students saw in the test tube is a mass

of DNA, as well as proteins, which have bonded together.

- ☞ **Take it Further** – Have the students try different kinds of fruit (like grapes or strawberries) or veggies (like an onion) to see if the DNA yield is more or less. The students can also try extracting some of their own DNA by swishing a little water around in their mouths and then spitting the liquid out into a bag. They should then add the extraction solution and follow the procedure as before.

Want More Activities

- ☞ **Punnett Square** – Have the students complete the Punnett Square worksheet found in the appendix on pp. 255-256.

Answers:

1.

GG	GG
Gg	Gg

50%, 50%, 0%

2.

GG	Gg
Gg	gg

25%, 50%, 25%

3.

Gg	Gg
gg	gg

0%, 50%, 50%

4.

Gg	Gg
Gg	Gg

0%, 100%, 0%

- ☞ **DNA Tower** – Have the students make a DNA tower using the directions from the following post:

📖 <https://elementalscience.com/blogs/science-activities/simple-lego-dna-tower>

Read—Gathering Information

- ☐ **Main Reading Assignment:** *Kingfisher Science Encyclopedia* p. 135 Genes and Chromosomes

Optional Research Readings

📖 Genetics: *USE* pp. 380-381, *UIDS* pp. 324-325

📖 Gene Therapy: *USE* pp. 382-383

- ☐ **Vocabulary:** genes, chromosomes (SG p. 16)
- ☐ **Memory Work:** This week, work on memorizing the Five Kingdoms and their Basic Characteristics. (SG p. 249)

Discussion Questions for Reading Assignments

1. What is the structure of DNA? (*DNA consists of two inter-locked strands that twist around each other in a structure known as a double helix.*)
2. Where are chromosomes found and what do they contain? (*Chromosomes are found in the nucleus of the cell. They contain genes, which are a set of instructions for an organism.*)
3. What is DNA made up of? (*DNA is made up of genes.*)
4. How do genes always occur? (*Genes always occur in pairs.*)

Biology Unit 1: Biological Building Blocks ~ Week 2 DNA and Genetics

5. How are genes passed? (*Genes are passed from parent to offspring.*)

Vocabulary

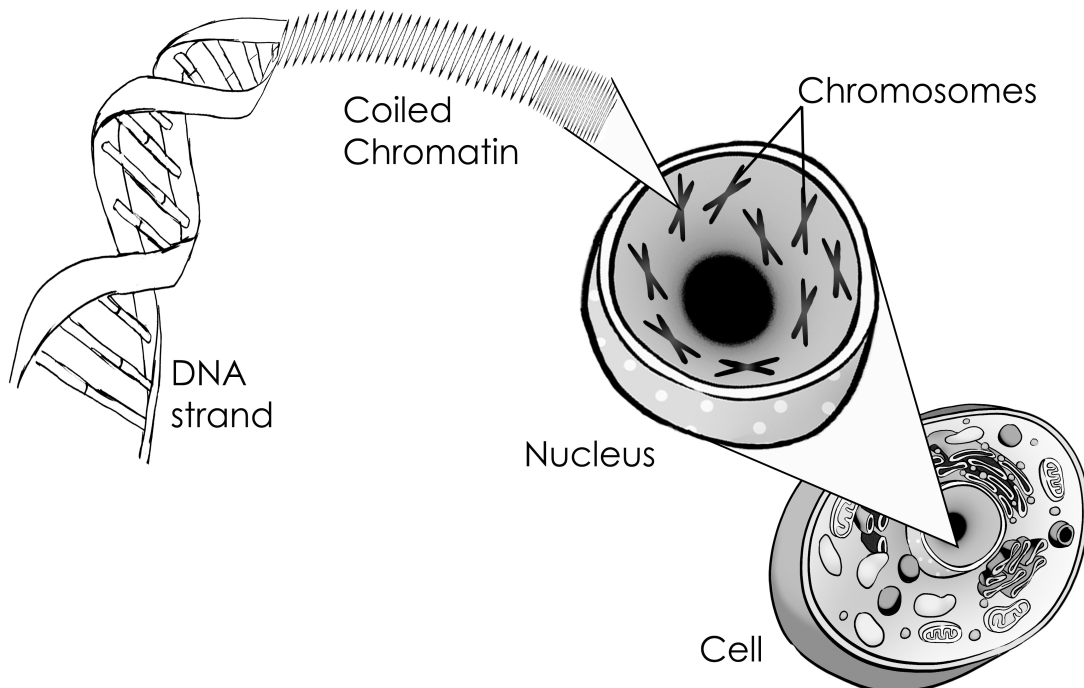
- ☐ **Genes** – A set of instructions that tell your body how to develop; found on the chromosomes.
- ☐ **Chromosomes** – Bundles of DNA that can be found in the cell's nucleus; they work together to tell an organism how to develop.

Write—Notebooking Assignments

- ☐ **Writing Assignments:** Write a list of facts, an outline, or a report. (SG pp. 28-29)
- ☐ **Sketch:** DNA to Chromosomes (SG p. 25)
 - ✍ Label the following – DNA strand, Coiled chromatin, Chromosomes, Nucleus, Cell
- ☐ **Dates to Enter** (SG pp. 11-14)
 - 🕒 1953 – James Watson and Francis Crick explain the double helix structure of DNA.

Sketch Assignment Answers

DNA to Chromosomes



*Biology
for the
Logic Stage*

Student Guide

A Peek Inside the Logic Stage Student Guide

Harness the benefits of notebooking and promote independent learning with the student guide.

1. Student Assignment Sheet

See the core of our logic stage programs—the student assignment sheets. This sheet has all the assignments for the week, with checkboxes to use.

2. Pre-drawn Sketch

Color the pre-drawn sketch relating to the week's topic. Then, label it with the information given on the Student Assignment Sheet.

3. Experiment Sheet

Do an experiment related to the topic for the week. The Experiment Sheet contains the introduction and the procedure for the experiment. It also has space to record the hypothesis, materials, observation, results, and conclusion.

4. Written Assignment

Know the questions for discussion time, and have plenty of space to write either a list of facts, an outline, or summary.

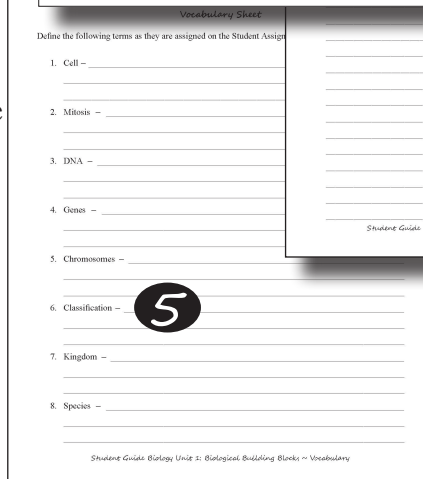
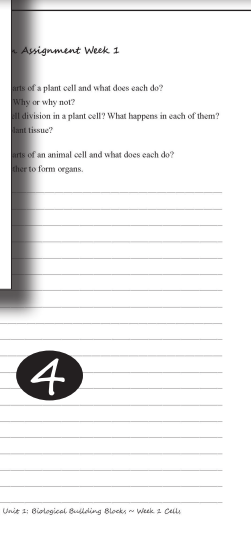
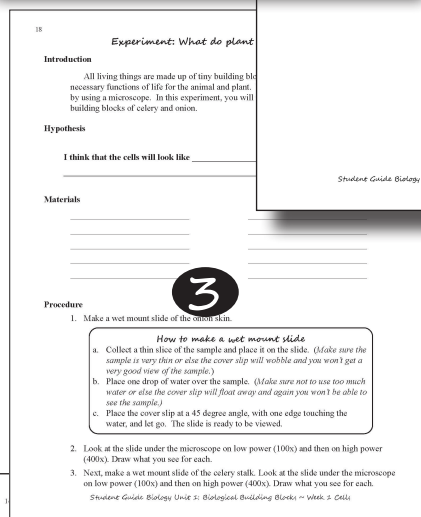
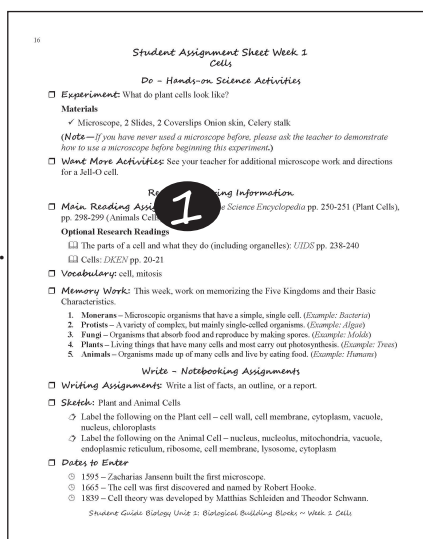
5. Unit Glossary

Keep all the unit vocabulary in one place. The glossary gives space to write the definitions for each the vocabulary word.

Additional Resources

The following page contains quick links to the activities suggested in this guide along with several helpful downloads:

 <https://elementalscience.com/blogs/resources/bls>



Classical SCIENCE

A Quick Welcome from the Author

Dear Student,

Welcome to your journey through biology, which is the study of living things. This year, you will examine the various structures of life and how they operate. You will look at plants, animals, and the human body along your voyage. We have written this guide for you, so enjoy your journey!

What does this program contain?

This year, you will study ecology, plants, invertebrates, vertebrates, animal behavior, and the human body in the following ways:

- ✓ Doing **hands-on science** through experiments and activities.
- ✓ Reading **scientific information** from visually appealing encyclopedias.
- ✓ Writing down what you have learned and seen using **organized notebooking**.

What does this guide contain?

At the beginning of this guide, you will find:

1. Date Sheets

For each unit, you will find:

2. The Unit Vocabulary Sheet
3. Weekly Student Assignment Sheets
4. Blank Sketches
5. Experiment Sheets
6. Space for the Writing Assignments

In the Appendix after the Unit Materials, you will find:

7. List of the Memory Work
8. The Glossary
9. A Place to Record Additional Activities

For a longer explanation of these components, see pp. 7-9.

As the author and publisher of this curriculum, I encourage you to contact me with any questions or problems that you might have concerning *Biology for the Logic Stage* at support@elementalscience.com. I will be more than happy to answer them as soon as I am able. I hope that you will enjoy *Biology for the Logic Stage*!

*Sincerely,
Paige Hudson*

Biology for the Logic Stage Student Guide

Table of Contents

Front Matter—		1
A Quick Welcome from the Author	3	
A Peek Inside the Logic Stage Student Guide	6	
A Deeper Look at the Components	7	
Sequence of Study	10	
Date Sheets—		11
Unit 1: Biological Building Blocks—		15
Vocabulary Sheet	16	
Cells	18	
DNA and Genetics	24	
Classification	30	
Nutrient Cycles	36	
Basic Ecology	42	
Unit 2: Plants—		49
Vocabulary Sheet	50	
Fungi	52	
Simple Plants	58	
Flowerless Plants	64	
Flowering Plants	70	
Seeds and Fruit	76	
Broadleaf Trees	82	
Unit 3: Invertebrates—		89
Vocabulary Sheet	90	
Annelids, Platyhelminthes, Nematodes	92	
Cnidarians and Echinoderms	98	
Mollusks	104	
Crustaceans (Arthropods)	110	
Insects (Arthropods)	116	
Unit 4: Vertebrates—		123
Vocabulary Sheet	124	
Fish	126	
Amphibians	132	
Reptiles	136	
Birds	142	
Mammals	148	

<i>Unit 5 Animal Overview—</i>	<i>155</i>
Vocabulary Sheet	156
Animal Research Project	158
Migration	162
Animal Defenses	168
Feeding and Nutrition	174
<i>Unit 6: The Human Body, part 1—</i>	<i>181</i>
Vocabulary Sheet	182
Integumentary System (Skin, Hair, and Nails)	184
Skeletal System	190
Muscular System	196
Nervous System	202
Endocrine System (Hormones)	208
<i>Unit 6: The Human Body, part 2—</i>	<i>213</i>
Vocabulary Sheet	214
Circulatory System	216
Respiratory System	222
Digestive System	228
Urinary System	234
Immune System	240
<i>Appendix—</i>	<i>247</i>
Memory Work by Unit	249
Activity Log	252
Biology Glossary	259

Biology for the Logic Stage *A Deeper Look at the Components*

How to Schedule this Study

Biology for the Logic Stage takes up to three hours per week. You, along with your teacher, can choose whether to complete the work over five days or over two days. Below are two options for scheduling to give you an idea of how you can schedule your week:

- ✓ A typical two-days-a-week schedule
 - ⌚ **Day 1** – Define the vocabulary, do the experiment, complete the experiment sheet, and record the dates.
 - ⌚ **Day 2** – Read assigned pages and discuss together, prepare the science report or outline, and complete the sketch.
- ✓ A typical five-days-a-week schedule
 - ⌚ **Day 1** – Do the experiment and complete the experiment sheet.
 - ⌚ **Day 2** – Record the dates and define the vocabulary.
 - ⌚ **Day 3** – Read assigned pages and discuss together and complete the sketch.
 - ⌚ **Day 4** – Prepare the science report or outline.
 - ⌚ **Day 5** – Complete one of the Want More activities from the Teacher Guide.

Student Assignment Sheets

The Student Assignment Sheets contain your weekly assignments for each week. Each of the student assignment sheets contains:

Do—Hands-on Science Activities

Experiment

Each week will revolve around a weekly topic. You will complete an assigned experiment that poses a question about what you are studying. Each Student Assignment Sheet contains the list of materials you will need and the instructions to complete the experiment. This guide also includes experiment sheets for you to fill out each week. In each of these experiments, you will use the scientific method.

A Word about the Scientific Method—The scientific method is a method for asking and answering scientific questions. Scientists achieve this by conducting observations and experiments. The following steps are key to the scientific method:

- 1. Ask a Question** – The scientific method begins with asking a question about something you observe. Your questions must be about something you can measure. Good questions begin with how, what, when, who, which, why, or where.
- 2. Do Some Research** – You need to read about the topic from your question so that you can have background knowledge of the topic. This will prevent you from

repeating the mistakes that people have made in the past.

3. **Formulate a Hypothesis** – A hypothesis is an educated guess about the answer to your question. Your hypothesis must be easy to measure and answer the original question you asked.
4. **Test with Experimentation** – Your experiment tests whether your hypothesis is true or false. It is important for your test to be fair. This means that you may need to run multiple tests. If you do, be sure to only change one factor at a time so that you can determine which factor is causing the difference.
5. **Record and Analyze Observations or Results** – Once your experiment is complete, you will collect and measure all your data to see if your hypothesis is true or false. Scientists often find that their hypothesis was false. If this is the case, they will plan a new hypothesis and begin the process again until they can answer their question.
6. **Draw a Conclusion** – Once you have analyzed your results, you can make a statement about them. This statement communicates your results to others.

Each of your experiment sheets will begin with a question and an introduction. The introduction will give you some background knowledge for the experiment. The experiment sheet also contains sections for the materials, a hypothesis, a procedure, an observation, and a conclusion. In the materials section, you need to fill out what you used to complete the experiment. In the hypothesis section, you need to predict the answer to the question posed in the lab. In the procedure section, you need to write a step-by-step account of what you did during your experiment. You need to provide enough detail so that someone else could read your report and replicate your experiment. In the observation section, you need to write what you saw and observed, as well as any results you measured. Finally, in the conclusion section, you need to write whether your hypothesis was correct and any additional information you have learned from the experiment. If your hypothesis was not correct, discuss why with your teacher and then include why your experiment did not work on your experiment sheet.

Safety Advisory—Do not perform any of the experiments marked “⚠️ **CAUTION**” on your own. Be sure you have adult supervision.

Want More Activities

Each week, you will find optional activities that relate to the topic. Your teacher will communicate with you if these activities are assigned for the week.

Read—Gathering Information

Main Reading Assignment

Each week, the student assignment page will give you a reading assignment for the topic from the spine texts, either *The Usborne Science Encyclopedia* or *The Kingfisher Science Encyclopedia*. After you have finished the assignment, discuss what you have read with your teacher. Your teacher may also assign additional research reading out of the following books:

 *The Usborne Science Encyclopedia*, 2015 Edition (USE)

 *The Kingfisher Science Encyclopedia*, 2017 Edition (KSE)

 *DK Encyclopedia of Nature*, 2007 Edition (DKEN)

 *Usborne Illustrated Dictionary of Science*, 2012 Edition (UIDS)

Vocabulary

Each week, you will be assigned vocabulary related to the topic. You will need to look up the word in the glossary on pp. 259-264 and fill out the definitions on the Unit Vocabulary Sheet found at the beginning of each unit. You may also want to make flash cards to help you work on memorizing these words.

Memory Work

Throughout the year, you will be assigned memory work for each unit. Simply repeat the selection until you have it memorized, and then say the selection to your teacher. There is a complete listing of the memory work selections in the appendix on pp. 249-252.

Write—Notebooking Assignments

Writing Assignments

Each week, your teacher will assign either a list of facts, an outline, and/or a narrative summary after you discuss your reading assignment with them. Your outlines should be one-level main topic style outlines and your narrative summaries should be one to three paragraphs, unless otherwise assigned by your teacher.

Sketch

Each week, you will be assigned a sketch to complete. Color the sketch and label it with the information given on the Student Assignment Sheet. Be sure to give your sketch a title.

Dates to Enter

Each week, dates of important discoveries within the topic and dates from the readings are given on the student assignment sheet. You will enter these dates onto one of four date sheets. The date sheets are divided into the four time periods laid out in *The Well-Trained Mind* by Susan Wise Bauer and Jessie Wise (Ancients, Medieval-Early Renaissance, Late Renaissance-Early Modern, and Modern). These sheets are found in the ongoing projects section of this guide. You can choose to just write the dates and information on the sheet or you can draw a timeline in the space provided and enter your dates on that.

Sequence of Study

Intro and Plant Units (11 weeks)

Unit 1: Biological Building Blocks (5 Weeks)

- ✓ Cells
- ✓ DNA and Genetics
- ✓ Classification
- ✓ Nutrient Cycles
- ✓ Ecology

Unit 2: Plants (6 Weeks)

- ✓ Fungi
- ✓ Simple Plants
- ✓ Flowerless Plants
- ✓ Flowering Plants
- ✓ Seeds and Fruit
- ✓ Trees

Human Body Unit (10 weeks)

Unit 6: Human Body (10 Weeks)

- ✓ Integumentary System
- ✓ Skeletal System
- ✓ Muscular System
- ✓ Nervous System
- ✓ Endocrine System (optional Reproductive System)
- ✓ Circulatory System
- ✓ Respiratory System
- ✓ Digestive System
- ✓ Urinary System
- ✓ Immune System

Review (1 week)

Animal Units (14 weeks)

Unit 3: Invertebrates (5 Weeks)

- ✓ Annelids/Platyhelminthes/Nematodes
- ✓ Cnidarians/Echinoderms
- ✓ Mollusks
- ✓ Arthropods
- ✓ Insects

Unit 4: Vertebrates (5 Weeks)

- ✓ Fish
- ✓ Amphibians
- ✓ Reptiles
- ✓ Birds
- ✓ Mammals

Unit 5: Animal Overview (4 weeks)

- ✓ Science Fair Project
- ✓ Migration
- ✓ Animal Behavior
- ✓ Animal Partnerships
- ✓ Adaptations and Defenses

Ancients 5000 BC-400 AD

Medieval-Early Renaissance 400AD-1600AD

Late Renaissance-Early Modern 1600 AD-1850 AD

Modern 1850 AD-Present

Biology *Unit 1*

Biological Building
Blocks

Unit 1: Biological Building Blocks Vocabulary Sheet

Define the following terms as they are assigned on the Student Assignment Sheet.

1. Cell – _____

2. Mitosis – _____

3. DNA – _____

4. Genes – _____

5. Chromosomes – _____

6. Classification – _____

7. Kingdom – _____

8. Species – _____

9. Nutrient – _____

10. Food Chain – _____

11. Food Web – _____

12. Ecosystem – _____

13. Ecology – _____

14. Habitat – _____

Student Assignment Sheet Week 1 Cells

Do—Hands-on Science Activities

- ☐ **Experiment:** What do plant cells look like?

Materials

✓ Microscope, 2 Slides, 2 Coverslips Onion skin, Celery stalk

(**Note**—If you have never used a microscope before, please ask the teacher to demonstrate how to use a microscope before beginning this experiment.)

- ☐ **Want More Activities:** See your teacher for additional microscope work and directions for a Jell-O cell.

Read—Gathering Information

- ☐ **Main Reading Assignment:** *Usborne Science Encyclopedia* pp. 250-251 (Plant Cells), pp. 298-299 (Animals Cells)

Optional Research Readings

 The parts of a cell and what they do (including organelles): *UIDS* pp. 238-240

 Cells: *DKEN* pp. 20-21

- ☐ **Vocabulary:** cell, mitosis

- ☐ **Memory Work:** This week, work on memorizing the Five Kingdoms and their Basic Characteristics.

1. **Monerans** – Microscopic organisms that have a simple, single cell. (*Example: Bacteria*)
2. **Protists** – A variety of complex, but mainly single-celled organisms. (*Example: Algae*)
3. **Fungi** – Organisms that absorb food and reproduce by making spores. (*Example: Molds*)
4. **Plants** – Living things that have many cells and most carry out photosynthesis. (*Example: Trees*)
5. **Animals** – Organisms made up of many cells and live by eating food. (*Example: Humans*)

Write—Notebooking Assignments

- ☐ **Writing Assignments:** Write a list of facts, an outline, or a report.

- ☐ **Sketch:** Plant and Animal Cells

 Label the following on the Plant cell – cell wall, cell membrane, cytoplasm, vacuole, nucleus, chloroplasts

 Label the following on the Animal Cell – nucleus, nucleolus, mitochondria, vacuole, endoplasmic reticulum, ribosome, cell membrane, lysosome, cytoplasm

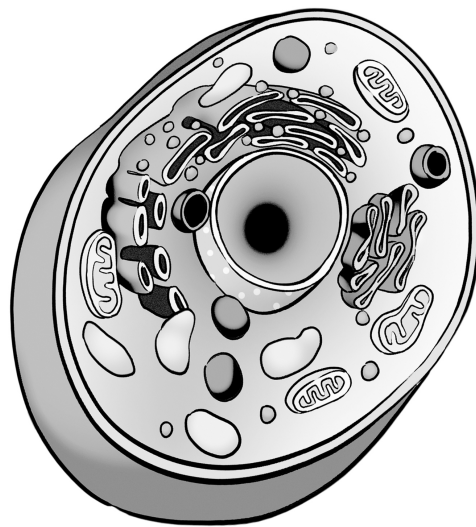
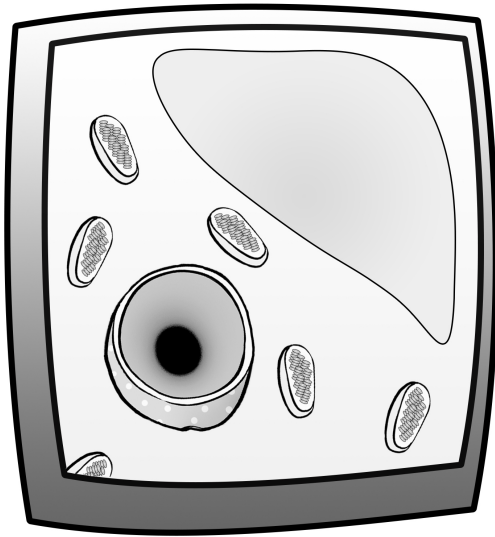
- ☐ **Dates to Enter**

 1595 – Zacharias Jansenn built the first microscope.

 1665 – The cell was first discovered and named by Robert Hooke.

 1839 – Cell theory was developed by Matthias Schleiden and Theodor Schwann.

Sketch Assignment Week 1



Experiment: What do plant cells look like?

Introduction

All living things are made up of tiny building blocks called cells. Cells carry out the necessary functions of life for the animal and plant. The best way to see these cells is by using a microscope. In this experiment, you will use a microscope to view the basic building blocks of celery and onion.

Hypothesis

I think that the cells will look like _____

Materials

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Procedure

1. Make a wet mount slide of the onion skin.

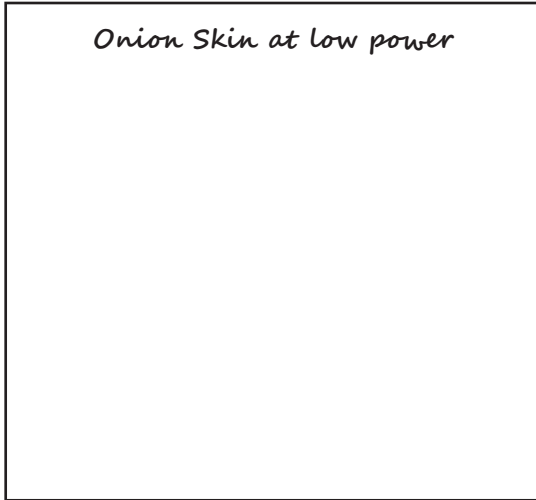
How to make a wet mount slide

- a. Collect a thin slice of the sample and place it on the slide. (*Make sure the sample is very thin or else the cover slip will wobble and you won't get a very good view of the sample.*)
- b. Place one drop of water over the sample. (*Make sure not to use too much water or else the cover slip will float away and again you won't be able to see the sample.*)
- c. Place the cover slip at a 45 degree angle, with one edge touching the water, and let go. The slide is ready to be viewed.

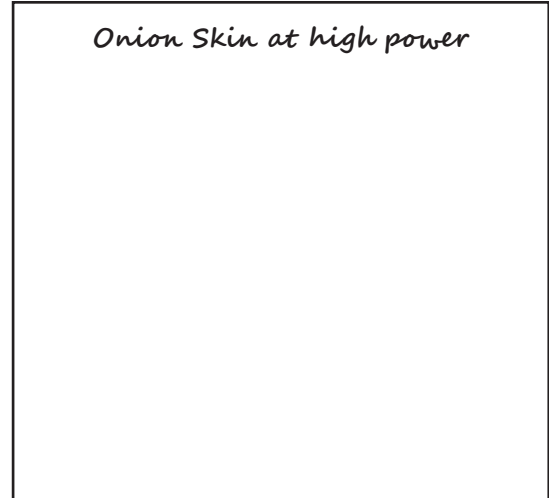
2. Look at the slide under the microscope on low power (100x) and then on high power (400x). Draw what you see for each.
3. Next, make a wet mount slide of the celery stalk. Look at the slide under the microscope on low power (100x) and then on high power (400x). Draw what you see for each.

Observations

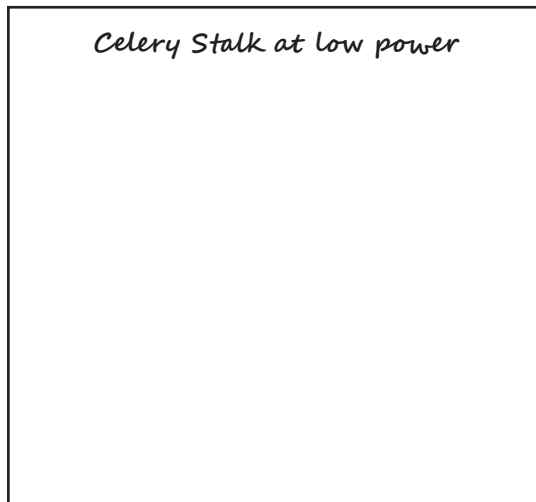
Onion Skin at low power



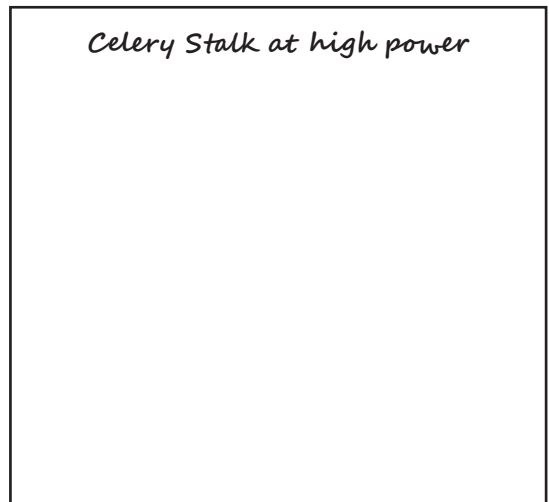
Onion Skin at high power



Celery Stalk at low power



Celery Stalk at high power



Conclusion

Written Assignment Week 1

Discussion Questions

Plant Cells, pp. 250-251

1. What are three of the basic parts of a plant cell and what does each do?
2. Are all plant cells the same? Why or why not?
3. What are the two stages of cell division in a plant cell? What happens in each of them?
4. What are the three types of plant tissue?

Animal Cells, pp. 298-299

1. What are three of the basic parts of an animal cell and what does each do?
2. Explain how cells come together to form organs.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Written Assignment Week 1

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Student Assignment Sheet Week 2 DNA and Genetics

Do—Hands-on Science Activities

- ☐ **Experiment:** DNA Extraction

Materials

- ✓ Banana Slices, Dish soap, Salt, Ice-cold isopropyl alcohol (70% or higher), Zipper-style plastic bag, Coffee filter, Funnel, Wooden coffee stirrer, Test tube (or clear glass)

- ☐ **Want More Activities:** See your teacher for directions on a DNA tower and optional Punnett Square worksheet.

Read—Gathering Information

- ☐ **Main Reading Assignment:** *Kingfisher Science Encyclopedia* p. 135 Genes and Chromosomes

Optional Research Readings

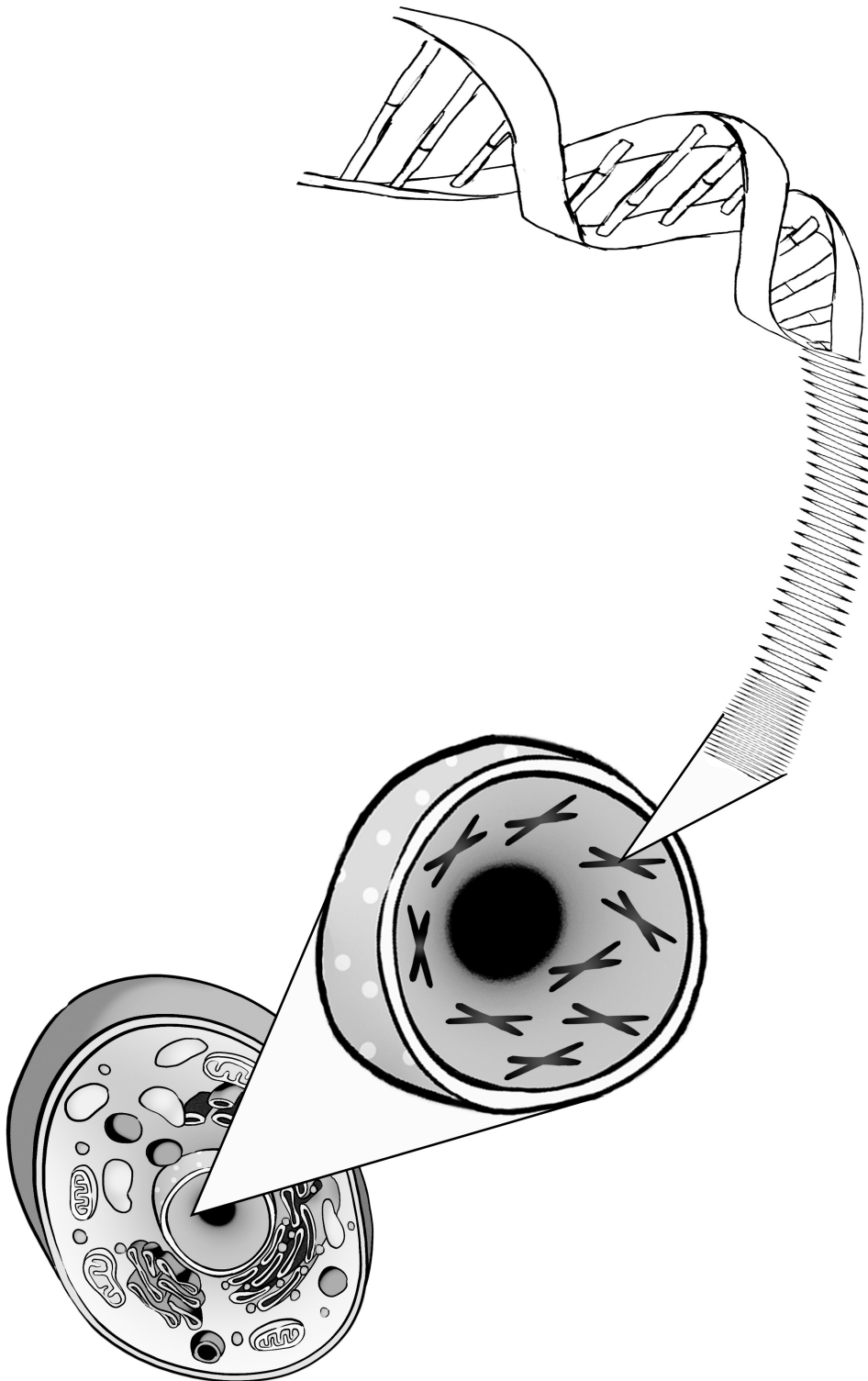
-  Genetics: *USE* pp. 380-381, *UIDS* pp. 324-325
-  Gene Therapy: *USE* pp. 382-383

- ☐ **Vocabulary:** DNA, genes, chromosomes
- ☐ **Memory Work:** This week, work on memorizing the Five Kingdoms and their Basic Characteristics.

Write—Notebooking Assignments

- ☐ **Writing Assignments:** Write a list of facts, an outline, or a report.
- ☐ **Sketch:** DNA to Chromosomes
-  Label the following – DNA strand, Coiled chromatin, Chromosomes, Nucleus, Cell
- ☐ **Dates to Enter**
-  1953 – James Watson and Francis Crick explain the double helix structure of DNA.

Sketch Assignment Week 2



Experiment: DNA Extraction

Introduction

DNA is the stuff that tells our cells what to do and how to look. It resides in the nucleus of a cell, so as you can imagine, it is quite tiny. In fact, you normally need a very powerful microscope to see DNA for yourself. In today's experiment, you are going to try to extract DNA and cause it to join up into a mass you can see.

Materials

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Procedure

1. Make the extraction solution by measuring out $\frac{1}{2}$ cup of water (120 mL). Add 2 tablespoons (35 mL) of liquid dish soap and 1 teaspoon (5 grams) of salt. Mix well.
2. Add several slices of banana to the baggie – about a third of a banana will do. Using your hands, squish the outside of the baggie to mash up the banana. Then, add 1 to 2 tablespoons (15 to 30 mL) of extraction solution. Keep squishing for about a minute or so to make sure that some of the DNA is released into the solution. (**Note**—*If you have time, you can let the mixture sit for ten to fifteen minutes so that even more DNA is released.*)
3. Line the funnel with the coffee filter and place the funnel in the test tube. Then, pour the contents of the baggie into the lined funnel and gently squeeze the liquid into the test tube. You want the tube to be about a quarter to a third full.
4. Slowly pour 2 to 3 tablespoons (30 to 45 mL) of the ice-cold alcohol into the test tube, so that you create a layer of alcohol resting on your fruit layer.
5. Watch what happens. Use the wooden coffee stirrer to gently stir the solution and collect any of the material you can see.

Observations and Results

Picture of what happened in the test tube

Conclusion

Written Assignment Week 2

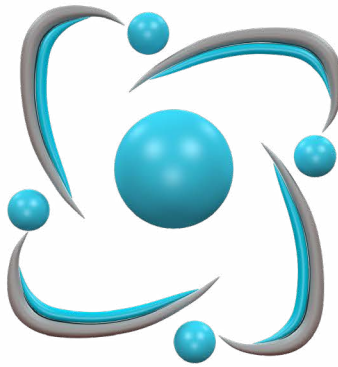
Discussion Questions

1. What is the structure of DNA?
2. Where are chromosomes found and what do they contain?
3. What is DNA made up of?
4. How do genes always occur?
5. How are genes passed?

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Written Assignment Week 2

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