Biology for the Logic Stage

Teacher Guide

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Sample File

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Biology for the Logic Stage
Introduction

In *Success in Science: A Manual for Excellence in Science Education*, 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."[1] The goals of science instruction at the logic level are to begin to train the students' brain 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.

This guide includes the four basic components of middle school science instruction as explained in *Success in Science*.

1. **Hands-on Inquiry —** Middle school students need to see real-life science, to build their problem solving skills and to practice using the basics of the scientific method. This can be done through experiments or nature studies. In this guide, the weekly experiments fulfill this section of middle school science instruction.
2. **Information —** Middle school students need to continue to build their knowledge base along with learning how to organize and store the information they are studying. The information component is an integral part of this process. In this guide, the reading assignments, vocabulary and sketches contain all of the necessary pieces of this aspect of middle school science instruction.
3. **Writing —** The purpose of the writing component is to teach the students how to process and organize information. You want them to be able to read a passage, pull out the main ideas and communicate them to you in their own words. The assigned outlines or reports in this guide give you the tools you need to teach this basic component to the students.
4. **The Science Project —** Once a year, all middle school student should complete a science project. Their project should work through the scientific method from start to finish on a basic level, meaning that their question should be relatively easy to answer. The science fair project, scheduled as a part of unit seven fulfills the requirements of this component.

Biology for the Logic Stage also includes the two optional components of middle school science instruction as explained in *Success in Science.*

1. **Around the Web —** Middle school students should gain some experience with researching on the Internet. So for this optional component, the students should, under your supervision, search the Internet for websites, YouTube videos, virtual tours and activities that relate to what they are studying. In this guide, the Want More lessons recommend specific sites and activities for you to use.
2. **Quizzes or Tests —** During the middle school years it is not absolutely necessary that you give quizzes or tests to the students. However, if you want to familiarize them with

[1]Bradley R. Hudson & Paige Hudson, Success in Science: A Manual for Excellence in Science Education, (Elemental Science, 2012) 52

test-taking skills, we suggest that you give quizzes or tests that will set the students up for success. With that in mind, we have included optional tests for you to use with each unit.

My goal in writing this curriculum is to provide you with the tools to explore the field of biology while teaching the basics of the scientific method. During the years, the students will work on their observation skills, learn to think critically about the information they are studying and practice working independently. *Biology for the Logic Stage* is intended to be used with fifth through sixth grade students.

What does this guide contains in a nutshell?

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 for you to use as you guide the students through *Biology for the Logic Stage*.

Student Guide

The Student Guide, which is sold separately, is designed to encourage independence in the students as they complete *Biology for the Logic Stage*. The 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 as well as all the sheets they will need for the Science Fair Project. In short, the Student Guide contains all the pages the students will need and it is essential for successfully completing this program.

Student Assignment Sheets

This Teacher Guide contains a copy of each of the student assignment sheets that are in the Student Guide. This way you can stay on top of what the students are studying. Each of the student assignment sheets contains the following:

- ✓ **Experiment**

  Each week will revolve around a weekly topic that it to be studied. 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 pg. 253 for a brief explanation of the scientific method). In a nutshell, the scientific method trains the brain to examine and observe before making a statement of fact. It will teach the students to look at all the facts and results before drawing a conclusion. If this sounds intimidating, it's not. You are simply teaching the students to take the time to discover the answer to a given problem by using the knowledge they have and the things they observe during an experiment.

  Each week, the student assignment sheet will contain a list of the materials needed and the instructions to complete the experiment. The student guide contains an experiment sheet for the students to fill out. Each experiment sheet contains an introduction that is followed

by a list of materials, a hypothesis, a procedure, an observation and a conclusion section. The introduction will give the students specific background information for the experiment. In the hypothesis section, they will predict the answer to the question posed in the lab. In the materials listed section, the students will fill out what they will use to complete the experiment. In the procedure section, they will recount step by step what was done during their experiment, so that someone else could read their report and replicate their experiment. In the observation section, the students will write what they saw. Finally, in the conclusion section they will write whether or not their hypothesis was correct and share any additional information they have learned from the experiment. If the students' hypothesis was not correct, discuss why and have them include that on their experiment sheet.

Vocabulary & Memory Work

Throughout the year, the students will be assigned vocabulary for each week. They will need to write out the definitions for each word on the Unit Vocabulary Sheet found in the Student Guide on 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. This year, the students will memorize the elements of the periodic table along with specific information relating 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.

Sketch

Each week the students will be assigned a sketch to complete and label. The Student Guide contains 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. So, these sketch assignments should make the student think. This guide contains a completed sketch for you to use when checking their work.

Writing Assignments

Each week the students will be assigned pages to read from one of the spine texts, either in *Encyclopedia of Nature* by DK or in *Kingfisher Science Encyclopedia*. Have them read the assigned pages and discuss what they have read with you. After you have finished reading and discussing the information, you have three options for the students' written assignment:

- ***Option 1: Have the students write an outline from the spine text***
  A typical seventh grader completing this program should be expected to write a two to three level outline for the pages assigned for the week. This outline should include the main point from each paragraph on the page as well as several supporting and sub supporting points;
- ***Option 2: Have the students write a narrative summary from the spine text***
  A typical seventh grader completing this program should be expected to write a three to six paragraph summary (or about a page) 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 to three level outline for the assigned pages. Next, have the students do

some additional research reading on the topic from one or more of the suggested reference books listed below. Each topic will have pages assigned from these reference books for their research. The following encyclopedias are scheduled to be used as reference books:

- 🕮 *The Usborne Internet-linked Science Encyclopedia* (UISE) — This resource is good for most 5th and 6th graders. It is also used in our grammar stage programs.
- 🕮 *The Kingfisher Science Encyclopedia* (KSE) — This resource is a slightly more advanced reference work than UISE. It is also the spine text for the astronomy portion of the study.
- 🕮 *Usborne Illustrated Dictionary of Science (UIDS)* — This resource is approaching the high school level.
- 🕮 *Human Body (DK Eyewitness Book)* — This resource is only for the human body study and is also approaching the high school level.

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

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

When evaluating the students' report, make sure that the information they have shared is accurate and that it has been presented in a grammatically correct form (i.e. look for spelling mistakes, run-on sentences and paragraph form). In the Student Guide, there are two blank lined sheets for the students to use when writing their outlines and/or summaries. If you are having the students type their report, have them glue a copy of it into their Student Guide.

🕒 **Dates**

Each week the dates of important discoveries within the topic and the dates from the readings 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 for you to use in the Appendix of this guide on pp. 241-244.

Schedules

Biology for the Logic Stage is designed to take up to 3 hours per week. You and the students can choose whether to complete the work over five days or over two days. Each week I have included two scheduling options for you to use as you lead them through this program. They are meant to be guides, so feel free to change the order to better fit the needs of the students. I also recommend that you begin to let them be in charge of choosing how many days they would like to do science as this will help to begin to foster independence in their school work. I have included two blank scheduling templates for you to use in the Appendix of this guide on pp. 253-254.

Additional Information Section

The Additional Information Section includes tools that you will find helpful as you guide the students through this study. It is only found in the Teacher Guide, and it contains the following:

- **Experiment Information**

  Each week, the Additional Information Section includes the expected experiment results and an explanation of those results for you to use with the students. When possible, you will also find suggestions on how to expand the experiment in the Take if Further section.

- **Discussion Questions**

  Each week the Additional Information Section includes possible discussion questions from the main reading assignment, along with the answers. These are designed to aid you in leading the discussion time with the students. I recommend that you encourage them to answer in complete sentences, as this will help them organize their thoughts for writing their outline or report. I have also included a list of the discussion questions without the answers at the end of each unit's material in this guide. This is so you can give them to the students ahead of time, if you desire, or you can use them to review for the unit test. If they are already writing outlines or lists of facts, you do not need to have them write out the answers to the discussion questions before hand as there is plenty of writing required in this program already.

- **Want More**

  Each week, the Additional Information Section includes a list of activities under the Want More section. ***These activities are totally optional.*** The Want More activities are designed to explore the science on a deeper level by researching specific topics or through additional projects to do. The students do not have this information in their guide, so it is up to you whether or not 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** (www.hometrainingtools.com)
  2. **Nasco Science Supplies** (www.enasco.com/science)
  3. **Carolina Biological Supply Company** (www.carolina.com)

  Since you will need to purchase a frog dissection kit for Week 19 from one of these companies, I have also included a list of the materials that you would need from a lab supply company for the optional Want More activities for your reference:

  - **Week 1:** Any type of slide that show cells (such as plant cells)
  - **Week 12:** Earthworm dissection kit
  - **Week 13:** Prepared slide with a water hydra
  - **Week 15:** Starfish dissection kit
  - **Week 21:** Owl Pellet dissection kit
  - **Week 27:** Prepared slides of human hair and skin
  - **Week 28:** Prepared slide of human bone cells
  - **Week 29:** Prepared slides of skeletal muscle, smooth muscle and cardiac muscle
  - **Week 30:** Sheep's brain dissection kit

- **Week 32:** Prepared slide of red blood cells, Sheep's heart dissection kit
- **Week 35:** Sheep's kidney dissection kit

☑ **Sketch**

Each week, the Additional Information Section includes copies of the sketches that have been labeled. These are included in this guide for you to use as you correct the students' work.

Tests

The students will be completing a lot of work each week that will help you to assess what they are learning, so testing is not absolutely necessary. However, I have included end of unit tests that you can use with the students if you feel the need to do so. The tests and the answers to them are included after the material for each unit in this guide, with the exception of Unit 6. Unit 6 has two tests, one mid-unit test that covers the first five weeks and one end of the unit test that covers the last 5 weeks. You can choose to give the tests orally or copy them for the students to fill out. (*If you have a print copy of this guide and would like a digital copy of the tests, please email us at info@elementalscience.com with your request and we will send them to you.*)

What a typical two day schedule looks like

A typical two day schedule will take one to one and a half hours per day. Here's a breakdown of how a normal two day week would work using week one:

- **Day 1:** ***Define the vocabulary, do the experiment as well as 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" & "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. 20-21 in the *Encyclopedia of Nature*. 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 multi-cellular 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 due to pressure from the inside. Also plant cells contain chloroplasts which are necessary for photosynthesis.

What a typical five day schedule looks like

A typical five day schedule will take thirty to forty-five minutes per day. Here's a breakdown of how a normal five day week would work using week one:

- **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. 20-21 in the *Encyclopedia of Nature* and 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" & "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. 250-251 & 298-299 in the *The Usborne Internet-linked Science Encyclopedia*. Then, have them use their outline or list facts along with what they have just read to write a 2 to 4 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 different types of 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. Animals 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 to produces food for a plant. Plant cells also have a sap-filled vacuole, chromoplasts, a cell membrane and a nucleus. Plants cells work together to form three main plant tissues.

- **Day 5:** ***Complete one of the Want More activities***

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

The Science Fair Project

I have scheduled time for the students complete a science fair project during Unit 5. *Janice VanCleave's A+ Science Fair Projects* & *Janice VanCleave's A+ Projects in Biology: Winning Experiments for Science Fairs and Extra Credit* are excellent resources for choosing a project topics within the field of biology. You can call your local school system to see if it allows homeschooled students to participate in the local school science fair or get information on national science fairs from them. Another option would be to have the students present their project in front of a group of friends and family.

How to Include Younger Students

I 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***

  I recommend this option if the younger students are in K-2nd grade and/or the older student is ready for some independence. You will need to rearrange the units in *Biology for the Logic*

Stage so that all the students will remain on similar topics. The older students will do Unit 1, 3 thru 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***

  I recommend this option if the younger students are in 2nd-4th grade and/or the older students are not ready to work independently. You will need to adjust the work load for the younger student. Here are some suggestions on how to do that:

  - ✓ Have them watch and observe the experiments. Do not expect them to predict the outcome of the experiment (hypothesis);
  - ✓ Add in some picture books from the library for each of the topics;
  - ✓ Read the reading assignments to them and have them narrate it back to you;
  - ✓ Let them 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 read to them out of the *Usborne Science Encyclopedia*, which is scheduled as an additional research reading resource or you can use the following books instead:

  - 🕮 *DK Encyclopedia of Animals*
  - 🕮 *DK First Human Body Encyclopedia*

  I have included a chart coordinating these resources in the Appendix of this guide on pp. 246-248.

Final Thoughts

If you find that this program contains too much work, please tailor it to the needs of your student. 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 info@elementalscience.com. I will be more than happy to answer them as soon as I am able. You may also get additional help and other supplemental material at our yahoo group (http://groups.yahoo.com/group/elemental_science/). I hope that you and your student enjoy *Biology for the Logic Stage*!

Book List

The following books were used when planning this study:

Encyclopedias for Reading Assignments

The following books are the main spines of this program. You will need to purchase both of these to complete the reading assignments scheduled in this program.

- 🕮 *Encyclopedia of Nature (DK Publishing)* ISBN # 978-0756631116
- 🕮 *The Kingfisher Science Encyclopedia* ISBN # 978-0753466889

References for Reports

The following encyclopedias are scheduled for additional reference reading. They are optional, but I suggest that you purchase one or two to use throughout the year. With the exception of the *Human Body* book, these encyclopedias will be scheduled in subsequent logic stage programs.

- 🕮 *The Usborne Internet-linked Science Encyclopedia (UISE)* — This resource is good for most 5th and 6th graders. ISBN # 978-0794530464
- 🕮 *Usborne Illustrated Dictionary of Science (UIDS)* — This resource is approaching the high school level. ISBN # 978-0794518479
- 🕮 *Human Body (DK Eyewitness Book)* — This resource is only for the human body study and is also approaching the high school level. (**Caution:** *This book is very graphic and is not for sensitive children.*) ISBN # 978-0756606886

Experiment Equipment

If you would like to create a more lab-like experience for the students this year, I suggest using 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.

Safety Advisory

Some of the experiments in this book use boiling water or open flames. We recommend that 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.

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 a LED or cool fluorescent bulb. Do not get one with mirror illumination as they are very 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). Be sure to also purchase some blank slides so that you can make your own slides. For more informaiton on purchasing a microscope, read the following article:

http://elementalblogging.com/microscope-for-homeschool/

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

http://elementalblogging.com/using-microscope-for-homeschool-science/

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 10:** Dissection of a Flower

What if I can't afford to purchase a microscope?

If you cannot afford to purchase a microscope or are unable to borrow a microscope, don't worry the students can still complete the experiments scheduled in this program. I have included links to websites where you can view the assigned slides in the "Additional Information" section in this guide. 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 that will require the use of a microscope:

- **Week 1**
- **Week 15**
- **Week 16**
- **Week 27**
- **Week 28**
- **Week 29**
- **Week 32**

Sequence of Study

Introductory & Plant Units (11 weeks)

Unit 1: Introduction and Ecology (5 Weeks)
- ✓ Cells
- ✓ Classification
- ✓ Food Chain/Food Web
- ✓ Nutrient Cycles
- ✓ Habitats

Unit 2: Plants (6 Weeks)
- ✓ Fungi
- ✓ Simple Plants
- ✓ Spore Bearing Plants
- ✓ Flowering Plants
- ✓ Flowers & Seeds
- ✓ Trees

Animal Units (15 weeks)

Unit 3: Invertebrates (6 Weeks)
- ✓ Annelids
- ✓ Platyhelminthes
- ✓ Nematodes
- ✓ Cnidarians
- ✓ Mollusks
- ✓ Arthropods

Unit 4: Vertebrates (5 Weeks)
- ✓ Fish
- ✓ Amphibians
- ✓ Reptiles
- ✓ Birds
- ✓ Mammals

Unit 5: Animal Overview (4 weeks)
- ✓ Science Fair Project
- ✓ Animal Research Project
- ✓ Migration
- ✓ Defenses
- ✓ Feeding & Nutrition

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

Materials Listed by Week

Introductory & Plant Units

Unit 1: Introduction & Ecology

Week	Materials
1	Microscope, Slides, Cover slips, Onion skin, Celery stalk
2	Leaf for identification
3	*No Experiment this week.*
4	Air dry clay, Shoebox, Paint or construction paper
5	Air dry clay, Paint or construction paper

Unit 2: Plants

Week	Materials
6	Bread, Plastic bag, Water
7	Pond or aquarium water, Small glass jar, Light source, 2 Slides and cover slips
8	Fern (with spores if possible), Magnifying glass, Microscope, Slide and cover slip
9	2 Cups, Soil, Bean seed, Corn seed, Marker
10	Flower (either lily, poppy or tulip), Razor, Magnifying glass, Microscope, Slide and cover slip
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	Marine animal pictures (can get from the Elemental Science website under Resources Tab or from the Elemental Science yahoo group in the files section)
16	3 Cups, 3 Uncooked shrimp shells, Bleach, Vinegar, Salt, Water, Gloves
17	1 Apple, 2 Glass jars

Unit 4: Vertebrates

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

Unit 5: Animal Overview

Week	Materials
23-26	Science Fair Project supplies will vary depending on the project the students choose to do.

Human Body Unit

Unit 6: Human Body

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

Unit 2: Plants
Overview of Study

Sequence of Study

Week 6: Fungi
Week 7: Simple Plants (Algae)
Week 8: Spore Bearing Plants (Ferns)
Week 9: Flowering Plants
Week 10: Flowers & Seeds
Week 11: Trees

Materials by Week

Week	Materials
6	Bread, Plastic bag, Water
7	Pond or aquarium water, Small glass jar, Light source, 2 Slides and cover slips
8	Fern (with spores if possible), Magnifying glass, Microscope, Slide and cover slip
9	2 Cups, Soil, Bean seed, Corn seed, Marker
10	Flower (either lily, poppy or tulip), Razor, Magnifying glass, Microscope, Slide and cover slip
11	Ruler, String, Measuring tape, Partner, Broadleaf tree

Vocabulary for the Unit

1. **Fungi —** Living things that absorb food from living or dead matter around them.
2. **Spore —** A microscopic package of cells produced by fungus or plant that can grow into a new individual.
3. **Yeast —** A microscopic, single-celled fungus.
4. **Algae —** A simple, plant-like organism that makes its food by photosynthesis.
5. **Lichen —** A plant-like partnership between a fungus and an alga.
6. **Photosynthesis —** A process that uses light energy to make food from simple chemicals.
7. **Chlorophyll —** The green chemical that gives most plants their color, it traps the sun's energy so that the plant can use it to make food.
8. **Frond —** The leaf of a fern or palm.
9. **Angiosperm —** A plant that reproduces by bearing flowers, fruit and seeds.
10. **Cotyledon —** A small leaf inside a seed.
11. **Dicot —** A flowering plant that has two cotyledons.
12. **Monocot —** A flowering plant that has one cotyledon.
13. **Anther —** The part of the flower that produces pollen.
14. **Pollination —** The transfer of pollen from the male part of a plant's flower to the female

part.

15. **Stigma —** The pollen-collecting tip of a female reproductive organ in a flower.
16. **Conifer —** A plant that reproduces by making cones.
17. **Deciduous —** A plant that sheds its leaves during some part of the year.
18. **Evergreen —** A plant that keeps its leaves throughout the year.

Memory Work for the Unit

Types of Roots

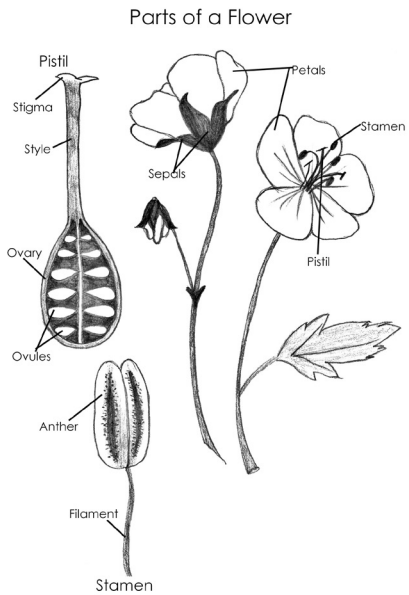
1. Tap-root (Carrot)
2. Fibrous root (Marigold)
3. Adventitious root (Strawberry)
4. Aerial root (Ivy)
5. Propagative root (Cherry)

Parts of a Flowering Plant

1. **Root** — It helps to anchor the plant and absorb nutrients.
2. **Stem** — It holds the plant up and serves as the transport system for the plant.
3. **Leaf** — It absorbs sunlight and produces energy for the plant through chlorophyll.
4. **Flower** — It is the reproductive part of the plant.
5. **Seed** — It contains the material necessary to grow a new plant.

Parts of a Flower

1. Petals
2. Sepals
3. Pistil
4. Stigma
5. Style
6. Ovary
7. Ovules
8. Stamen
9. Anther
10. Pollen
11. Filament



Notes

Student Assignment Sheet Week 6
Fungi

Experiment: Can I grow mold?

Materials

- ✓ Bread
- ✓ Plastic bag
- ✓ Water

Procedure

1. Read the introduction to this experiment and then answer the question.
2. Moisten the bread by sprinkling it with water.
3. Place it in the plastic bag and set the bag in a warm, dark place.
4. Observe the bag daily. Be sure to take a picture or draw what you see on the experiment sheet.
5. After 5 days, make your final observations, finish the experiment sheet and throw the bread away. **DO NOT** open the plastic bag.

Vocabulary & Memory Work

- ☐ Vocabulary: fungi, spores, yeast
- ☐ Memory Work — Begin working on Types of Roots along with an example of each.
  1. Tap-root (Carrot)
  2. Fibrous root (Marigold)
  3. Adventitious root (Strawberry)
  4. Aerial root (Ivy)
  5. Propagative root (Cherry)

Sketch: Life cycle of a Mushroom

- 🖼 Label the following: Mushrooms start to form, mycelium grow, button elongates, outer skin splits and pores under cap are exposed to air, cap grows and pores shed their spores

Writing

- Reading Assignment: *Encyclopedia of Nature* pp. 114-115 Fungi
- Additional Research Reading
  - 🕮 Fungi: UISE pp. 284-285
  - 🕮 Fungi & Lichens: KSE pg. 55

Dates to Enter

- 1588 — Giambattista della Porta first observes fungal spores.
- 1836 — English naturalists Miles Joseph Berkeley first used the word mycology to mean the study of fungi.
- 1928 — Alexander Fleming discovers penicillin.

Schedules for Week 6

Two Days a Week

Day 1	Day 2
☐ Define fungi, spore & yeast on SG pg. 42 ☐ Begin the "Can I grow mold?" experiment, then fill out the experiment sheet on SG pp. 46-47 ☐ Enter the dates onto the date sheets on SG pp. 9-12	☐ Read pp. 114-115 from the *Encyclopedia of Nature,* then discuss what was read ☐ Color and label the "Life Cycle of a Mushroom" sketch on SG pg. 45 ☐ Prepare an outline or narrative summary, write it on SG pp. 48-49 ☐ Finish the experiment sheet on SG pp. 46-47
Supplies I Need for the Week ✓ Bread ✓ Plastic bag ✓ Water	
Things I Need to Prepare	

Five Days a Week

Day 1	Day 2	Day 3	Day 4	Day 5
☐ Begin the "Can I grow mold?" experiment, then fill out the experiment sheet on SG pp. 46-47 ☐ Enter the dates onto the date sheets on SG pp. 9-12	☐ Read pp. 114-115 from the *Encyclopedia of Nature,* then discuss what was read ☐ Write an outline or list of facts on SG pg. 48	☐ Define fungi, spore & yeast on SG pg. 43 ☐ Color and label the "Life Cycle of a Mushroom" sketch on SG pg. 45	☐ Read one or all of the additional reading assignments ☐ Prepare a report, write the report on SG pg. 49	☐ Finish the experiment sheet on SG pp. 46-47 ☐ Complete one of the Want More Activities listed **OR** ☐ Study a scientist from the field of Biology
Supplies I Need for the Week ✓ Bread ✓ Plastic bag ✓ Water				
Things I Need to Prepare				

Additional Information Week 6

Experiment Information

- **Introduction** — (*from the Student Guide*) Mold is neither a plant nor an animal. It is part of the Fungi Kingdom and is usually found in dark, damp places. Mold does not contain chlorophyll, so it cannot produce its own food from light like most other plants. Instead mold feeds on living or once living matter. In this experiment, you will see if you can grow mold using a piece of bread.
- **Results — DO NOT** let the students remove their moldy bread from the plastic bag as you could have grow mold that is harmful. The students' bread should grow mold within 3 to 4 days. The students should be able to observe several different types of mold on the bread.
- **Explanation —** There are mold spores floating around in the air which were trapped in the plastic bag. They land on the bread and begin to take root. The growing mold breaks down the bread to supply its cells with they food they need. *NOTE: Mold prefers a dark, moist environment to grow in, which is the reason we had to wet the bread a bit.*
- **Troubleshooting —** If you did not observe any mold, this is probably due to the preservatives found in some types of bread. You can have the students redo the experiment with bread that does not contain preservatives or just have them write up their results, noting that the presences of preservatives prevented the mold from growing.
- **Take it Further —** Have the students look at mold in the bag under a microscope and complete a microscope worksheet found on pg. 255 of the Appendix. After you have put on gloves and a protective mask, very carefully open the bag with moldy bread and use a Q-tip to obtain a sample. Then, spread some of it on a slide and add a drop of water. Cover it with a cover slip and look at it under the microscope. DO NOT remove the bread completely from the bag. Be sure to properly discard of the bread and Q-tip once you have the sample.

CAUTION

DO NOT allow the students to do the "Take it Further" activity without supervision. Make sure to first put on gloves and a protect mask as the students may have grown some toxic mold.

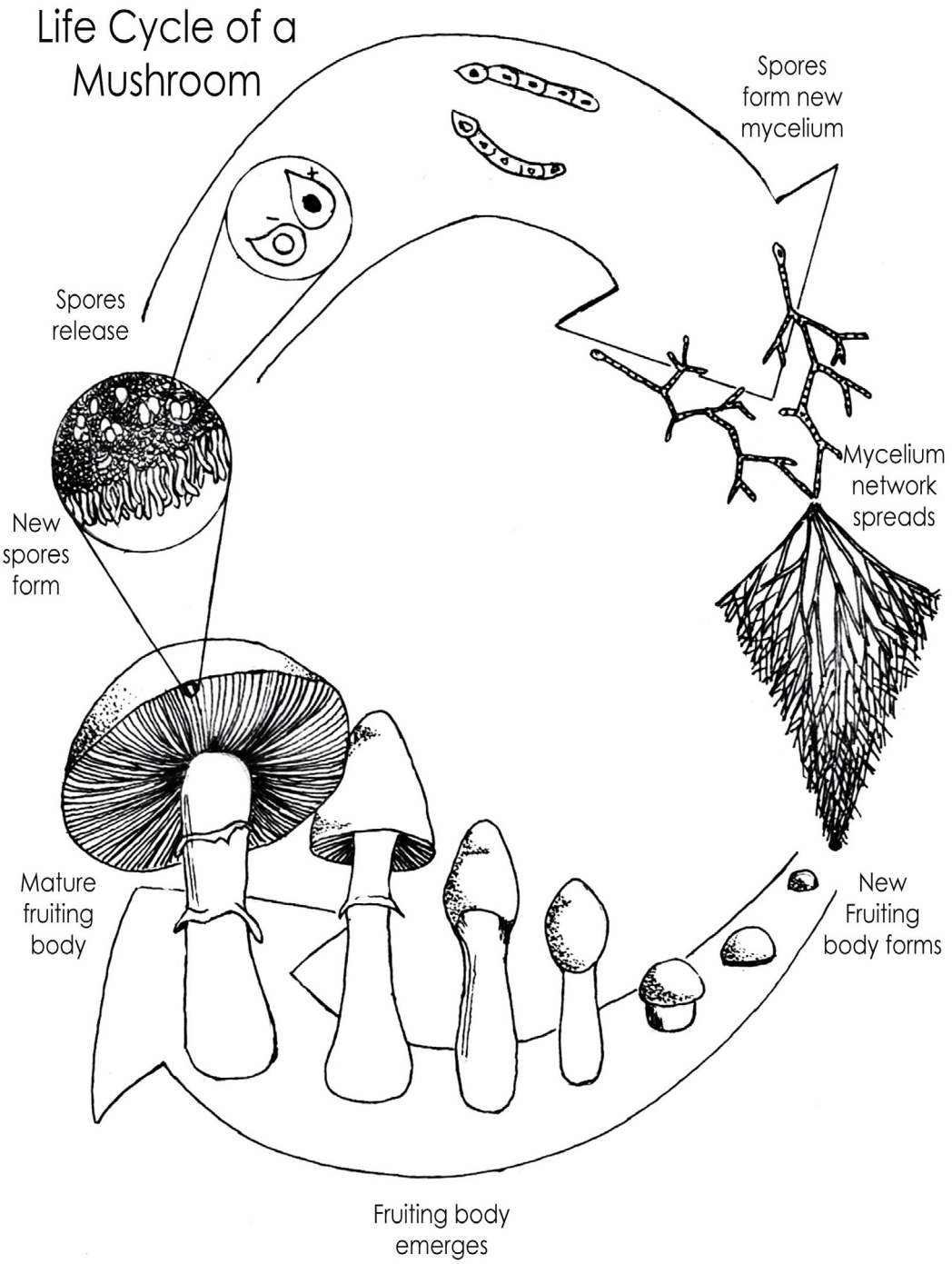
Discussion Questions

1. Are fungi plants or animals? (*Fungi are neither plants nor animals*.)
2. How do fungi get their food? (*Fungi release enzymes that decompose living and dead organisms, and then they absorb the nutrients*.)
3. Generally, how do fungi reproduce? (*Fungi usually reproduce by using spores*.)
4. Explain how yeasts reproduce. (*Yeasts reproduce by first budding. Next the new cells grow out like bubbles from the parent cell. Then when they are big enough, they split off from the parent cell.*)
5. How are spores dispersed? (*Spores are dispersed by the wind*.)
6. How is penicillin mold useful to humans? (*Penicillin mold is useful to humans because it produces an antibiotic that kills the bacteria*.) Where does it usually grow? (*It normally grows on decaying fruit.*)

Want More

- **Spore Prints —** Have the students make spore prints by following the directions found on UISE pg. 285.

Sketch Assignment Week 6



Student Assignment Sheet Week 7
Simple Plants (Algae)

Experiment: Can I grow algae?

Materials

- ✓ Pond or aquarium water
- ✓ Small glass jar
- ✓ Eye dropper
- ✓ Microscope
- ✓ 2 Slides and cover slips

Procedure

1. Read the introduction to this experiment and then answer the question.
2. Collect some pond or aquarium water in a small glass jar.
3. Place a drop of water onto a slide and cover it with a cover slip, using the same method you learned in week one.
4. Look at it under the microscope using the 10x objective lens. Move the slide around slowly to see if you can find any green algae cells.
5. Set the jar out on a sunny window sill and observe what happens in the jar over 5 days.
6. After five days, look at the water under the microscope again using the same procedure you did in steps three and four. Then complete the experiment sheet.

Vocabulary & Memory Work

- ☐ Vocabulary: algae, lichen, photosynthesis
- ☐ Memory Work — Continue to work on the Types of Roots.

Sketch: Anatomy of an Bladder Wrack

- 🖼 Label the following: fronds, gas bladders, stalk

Writing

- Reading Assignment: *Encyclopedia of Nature* pp. 118-119 Algae & Lichens
- Additional Research Reading
  - 🕮 Photosynthesis: UISE pp. 264-265 OR UIDS pp. 254-255
  - 🕮 Photosynthesis: *Encyclopedia of Nature* pp. 24-25
  - 🕮 Water Plants: UISE pp. 280-281

Dates to Enter

- 🕒 2600 BC- 2000 BC — Ancient Egyptians used different colors of algae as eye make-up.
- 🕒 1811-1866 — William Harvey was the first to divide algae into four divisions based on their pigmentation.

Schedules for Week 7

Two Days a Week

Day 1	Day 2
☐ Define algae, lichen & photosynthesis on SG pg. 42 ☐ Begin the "Can I grow algae?" experiment, then fill out the experiment sheet on SG pp. 52-53 ☐ Enter the dates onto the date sheets on SG pp. 9-12	☐ Read pp. 118-119 from the *Encyclopedia of Nature*, then discuss what was read ☐ Prepare an outline or narrative summary, write it on SG pp. 54-55 ☐ Color and label the "Anatomy of a Bladder Wrack" sketch on SG pg. 51 ☐ Finish the experiment sheet on SG pp. 52-53
Supplies I Need for the Week ✓ Pond or aquarium water ✓ Small glass jar ✓ Eye dropper ✓ Microscope ✓ 2 Slides and cover slips	
Things I Need to Prepare	

Five Days a Week

Day 1	Day 2	Day 3	Day 4	Day 5
☐ Begin the "Can I grow algae?" experiment, then fill out the experiment sheet on SG pp. 52-53 ☐ Enter the dates onto the date sheets on SG pp. 9-12	☐ Read pp. 118-119 from the *Encyclopedia of Nature*, then discuss what was read ☐ Write an outline or list of facts on SG pg. 54	☐ Define algae, lichen & photosynthesis on SG pg. 42 ☐ Color and label the "Anatomy of a Bladder Wrack" sketch on SG pg. 51	☐ Read one or all of the additional reading assignments ☐ Prepare a report, write the report on SG pg. 55	☐ Finish the experiment sheet on SG pp. 52-53 ☐ Complete one of the Want More Activities listed **OR** ☐ Study a scientist from the field of Biology
Supplies I Need for the Week ✓ Pond or aquarium water, Small glass jar ✓ Eye dropper, Microscope ✓ 2 Slides and cover slips				
Things I Need to Prepare				

Additional Information Week 7

Experiment Information

- **Note —** If you don't own a microscope you can view algal cells at this website:
  http://en.wikipedia.org/wiki/Green_algae
  This article has several different pictures of green algae under a microscope.
- **Introduction** — (*from the Student Guide*) Green alga is the most diverse category of algae. There are over 7000 different species that grow in many types of aquatic habitats. Green algae have chlorophyll which captures light and uses it to produce sugars for food. In this experiment, you will be attempting to grow green algae from either water from a pond or an aquarium.
- **Results —** The students should see your water get a bit greener after 5 days. The students should also see additional algae cells under the microscope when they examine their water sample.
- **Explanation —** Green algae grow in most freshwater environments. When you place your sample in a sunny window the algae is able to produce more food because of the additional sunlight. Thus it is able to reproduce more rapidly and you are able to see the presence of algae with your naked eye.
- **Troubleshooting —** If the students are unable to grow algae in their glass jar, this may be due to the presence of chlorine or another algaecide in the water. You can test for the presence of chlorine using a test kit made for a pool or aquarium, if you desire. You could also try to add a fertilizer, such as liquid plant food, to help encourage algal growth.
- **Take it Further —** Read and research about Red Tide, which is a deadly overgrowth of red algae that grows on the oceans.

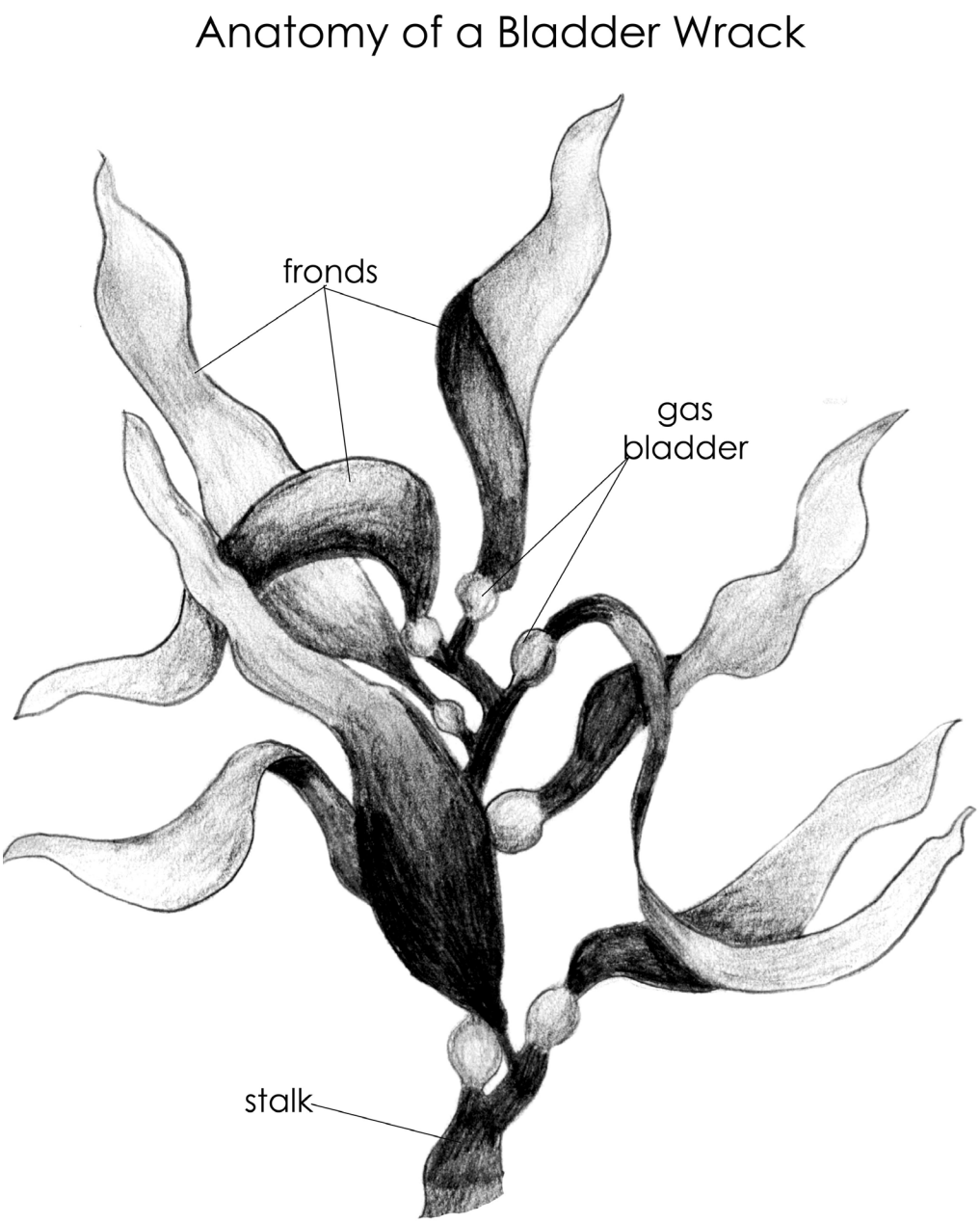
Discussion Questions

1. Where are most species of algae found? (*Most species of algae are found in the ocean, in lakes or in ponds*.)
2. How are algae different from other plants? (*Algae differ from other plants because they have no roots, leaves or flowers*.) How are they similar? (*Algae are similar to other plants because they have chlorophyll & they make their own food by photosynthesis*.)
3. Why do red & brown algae contain an additional pigment? (*Red & brown algae contain an additional pigment which enable them to do photosynthesis in deeper water than just chlorophyll alone will allow*.)
4. Where is most green algae found? (*Most green algae is found in freshwater*.)
5. Do algae reproduce asexually or sexually? (*Algae reproduce sexually*.)
6. What are lichens made up of? (*Lichens are a fungus combined with either an algae or a bacteria*.)
7. Name and describe the three most common types of lichen growth forms. (*The three most common types of lichens are fruticose, foliose and crutose. Fruticose are shrub like, foliose are leaf like, and crutose are flat & crusty*.)

Want More

- **Read More —** Have the students read about Reproduction on pp. 28-29 in *Encyclopedia of Nature*.

Sketch Assignment Week 7



Student Assignment Sheet Week 8
Spore-Bearing Plants (Fern)

Experiment: Observation of a Fern

Materials

- ✓ Fern frond (with spores if possible)
- ✓ Magnifying glass
- ✓ Microscope
- ✓ Slide & cover slip

Procedure

1. Read the introduction to this experiment.
2. Observe the fern using your eyes and the magnifying glass, and then answer the questions on the experiment sheet.
3. Make a wet mount slide using the directions from the experiment in week one. Look at the slide using the 40x objective, then draw what you see on the experiment sheet.
4. Draw conclusions and complete the experiment sheet.

Vocabulary & Memory Work

- ☐ Vocabulary: chlorophyll, frond
- ☐ Memory Work — Continue to work on the Types of Roots.

Sketch: Life Cycle of a Fern

- 🖼 Label the following: mature plant produces sori which contain clusters of sporangia, sporangia release spores into the air, spores grow into the prothallus which produces the sex cells, the male and female sex cells fuse, the resulting cell grows into a fern plant

Writing

- ✍ Reading Assignment: *Encyclopedia of Nature* pp. 122-123 Ferns & Horsetails
- ✍ Additional Research Reading
  - 🕮 Flowerless Plants: UISE pp. 282-283 OR *Encyclopedia of Nature* pp. 116-117
  - 🕮 Non-flowering Plants: KSE pg. 58
  - 🕮 Leaves: UIDS pp. 248-250

Dates to Enter

- 🕒 1855 — Charles Kingsley coins the term Pteridomania or Fern Craze to describe the Victorian era craze of fern collecting and decorating with the fern motif in pottery and glass.

Schedules for Week 8

Two Days a Week

Day 1	Day 2
☐ Define chlorophyll & frond on SG pg. 42 ☐ Do the "Observation of a Fern" experiment, then fill out the experiment sheet on SG pp. 58-59 ☐ Enter the dates onto the date sheets on SG pp. 9-12	☐ Read pp. 122-123 from the *Encyclopedia of Nature*, then discuss what was read ☐ Prepare an outline or narrative summary, write the report on SG pp. 60-61 ☐ Color and label the "Life cycle of a fern" sketch on SG pg. 57
Supplies I Need for the Week ✓ Fern (with spores if possible) ✓ Magnifying glass ✓ Microscope ✓ Slide & cover slip	
Things I Need to Prepare	

Five Days a Week

Day 1	Day 2	Day 3	Day 4	Day 5
☐ Do the "Observation of a Fern" experiment, then fill out the experiment sheet on SG pp. 58-59	☐ Read pp. 122-123 from the *Encyclopedia of Nature*, then discuss what was read ☐ Write an outline or list of facts on SG pg. 60	☐ Define chlorophyll & frond on SG pg. 42 ☐ Enter the dates onto the date sheets on SG pp. 9-12 ☐ Color and label the "Life cycle of a fern" sketch on SG pg. 57	☐ Read one or all of the additional reading assignments ☐ Prepare a report, write the report on SG pg. 61	☐ Complete one of the Additional Activities listed **OR** ☐ Study a scientist from the field of Biology
Supplies I Need for the Week ✓ Fern (with spores if possible) ✓ Magnifying glass ✓ Microscope ✓ Slide & cover slip				
Things I Need to Prepare				

Additional Information Week 8

Notes

- **Sketch —** The sketch for this week is slightly different that the picture in the book. You may have to help the students label it this week.

Experiment Information

- **Note —** If you don't have a microscope, view the following You Tube video from Matin Microscope about fern spores:
  http://www.youtube.com/user/MartinMicroscope#p/a/u/1/5hGQcmM6njY
- **Introduction** — (*from the Student Guide*) Ferns are primitive plants that are generally found in humid forests and near river banks. Ferns do not flower. They also release spores instead of seeds. In this experiment, you will examine and observe the structure of a fern.
- **Results** — The students should make some observations about a fern. They should be able to see layers of plant cells when they look at the fern under the microscope.
- **Explanation** — The goal of this experiment was to get the students to practice their observation skills. If they were able to draw the fern and the plant cells they saw, they have accomplished the purpose of this experiment.
- **Take it Further** — Have the students make a fern book. Go on a nature walk in the woods to see what types of ferns you can find, take samples and press them so that you can make a fern identification book.

Discussion Questions

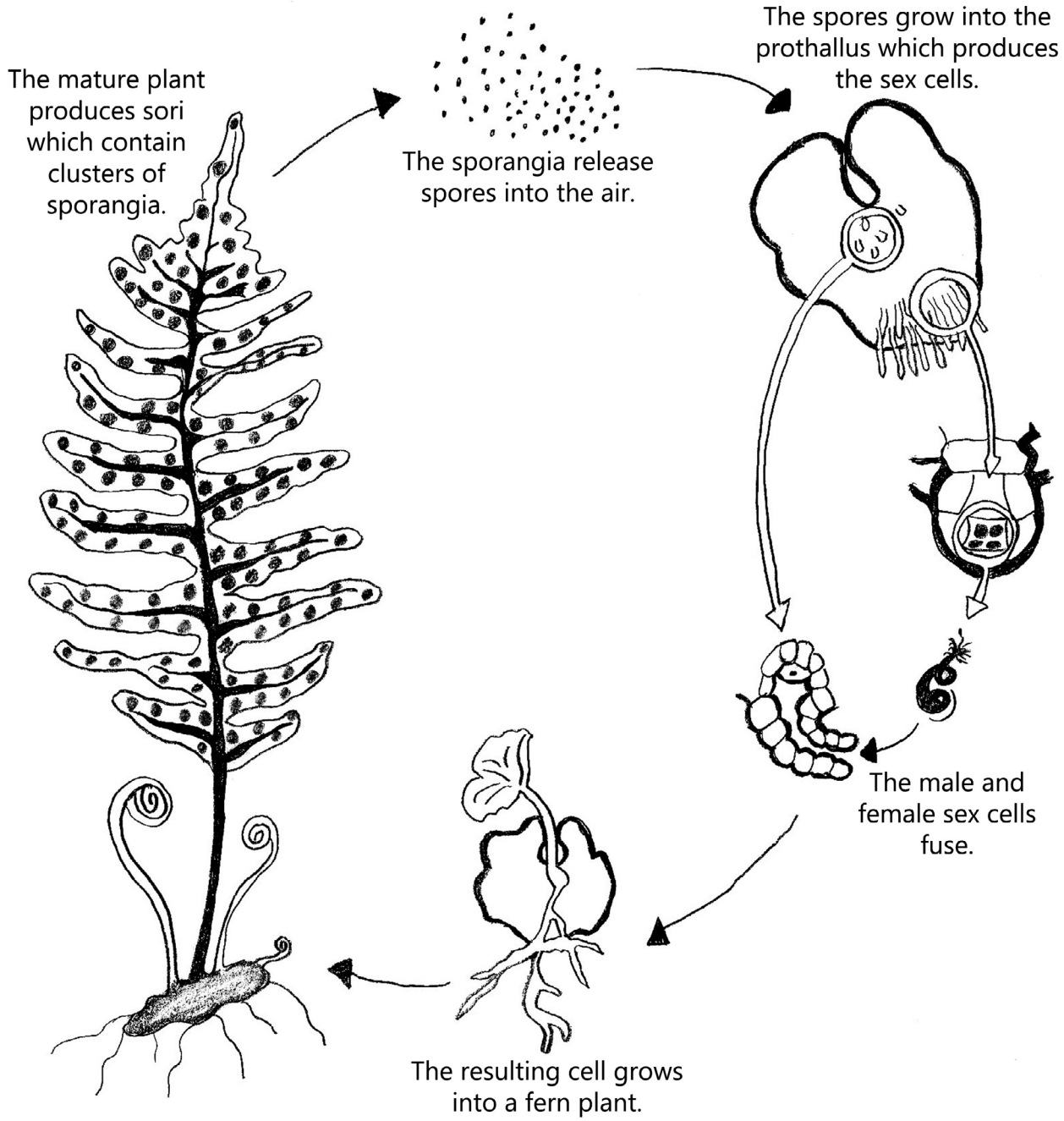
1. What type of environment do ferns prefer? (*Ferns prefer an environment that is humid, which is usually found in forests or near river banks*.)
2. Describe how a fern grows. (*A fern grows by forming small buds at the base of the plant on the stem. Then these buds mature and unroll. Finally the leaflets unroll and grow to maturity quickly*.)
3. How do ferns reproduce? (*Ferns reproduce by using spores*.)
4. What is an epiphyte? (*An epiphyte is a plant that takes root on the boughs and trunks of a tree*.)
5. How do epiphyte ferns obtain the water and food they need? (*An epiphyte obtains water from rain trickling down the tree. It obtains food by absorbing nutrients from dead insects, leaves and droppings*.)

Want More

- **Read More** — Have the students read about Mosses & Liverworts on pp. 120-121 in *Encyclopedia of Nature*.

Sketch Assignment Week 8

Life Cycle of a Fern



Unit 2: Plants
Unit Test

Vocabulary Matching

1. Fungi ___
2. Spore ___
3. Yeast ___
4. Algae ___
5. Lichen ___
6. Photosynthesis ___
7. Chlorophyll ___
8. Frond ___
9. Angiosperm ___
10. Cotyledon ___
11. Dicot ___
12. Monocot ___
13. Anther ___
14. Pollination ___
15. Stigma ___
16. Conifer ___
17. Deciduous ___
18. Evergreen ___

A. A microscopic, single-celled fungus.

B. The pollen-collecting tip of a female reproductive organ in a flower.

C. A plant-like partnership between a fungus and an alga.

D. Living things that absorb food from living or dead matter around them.

E. A flowering plant that has one cotyledon.

F. A simple, plant-like organism that makes its food by photosynthesis.

G. The transfer of pollen from the male part of a plant's flower to the female part.

H. The green chemical that gives most plants their color, it traps the sun's energy so that the plant can use it to make food.

I. A plant that keeps its leaves throughout the year.

J. A microscopic package of cells produced by fungus or plant that can grow into a new individual.

K. A small leaf inside a seed.

L. A plant that sheds its leaves during some part of the year.

M. The part of the flower that produces pollen.

N. The leaf of a fern or palm.

O. A plant that reproduces by bearing flowers, fruit and seeds.

P. A plant that reproduces by making cones.

Q. A flowering plant that has two cotyledons.

R. A process that uses light energy to make food from simple chemicals.

True or False

1. _____ Fungi are part of the animal kingdom.

2. _____ Spores are released from a fungus and dispersed by the wind to a new location where they begin the life cycle of a fungus again.

3. _____ All varieties of green algae are found in the ocean.

4. _____ Lichen are made up of a combination of fungus and either an algae or a bacteria.

5. _____ Ferns reproduce by using seeds.

6. _____ An epiphyte takes root on the ground.

7. _____ The tulip and the orchid are monocotyledons because they have only one seed leaf.

8. _____ Plants grow from their center.

9. _____ A self pollinating plant is able to pollinate itself.

10. _____ Fruit is formed in the ovary of a flower.

11. _____ When deciduous trees lose their leaves in the fall, the chlorophyll remains in the leaf that is shed from the tree.

12. _____ Many deciduous trees have broad, flat leaves that make them more efficient at photosynthesis.

Short Answer

1. How do fungi get their food?

2. Explain how yeasts reproduce.

3. How are algae similar to other plants?

   How are algae different from other plants?

4. How does a fern grow?

5. Name three parts of a plant and tell what they do.

6. Label the petals, stamen, anther, pistol, stigma and ovary on the flower below.

7. What are 3 ways that a seed can be dispersed?

8. What is the main difference between deciduous and evergreen trees?

Unit 2: Plants
Unit Test Answers

Vocabulary Matching

1. D
2. J
3. A
4. F
5. C
6. R
7. H
8. N
9. O
10. K
11. Q
12. E
13. M
14. G
15. B
16. P
17. L
18. I

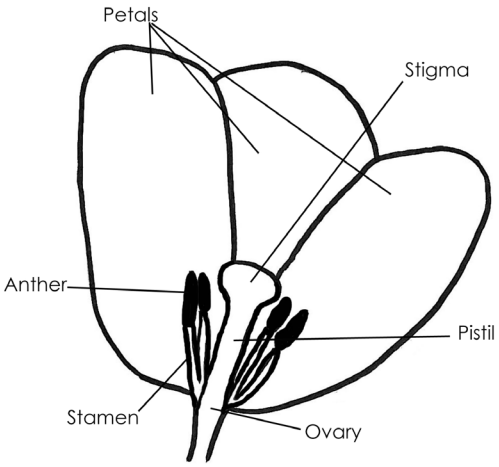
True or False

1. False (*Fungi are not a part of the plant or animal kingdom, instead it has its own kingdom*.)
2. True
3. False (*Green algae is found in the ocean, lakes, and ponds.*)
4. True
5. False (*Ferns reproduce using spores*.)
6. False (*An epiphyte takes root in the boughs or trunk of a tree*.)
7. True
8. False (*Plants grow from their tips*.)
9. True
10. True
11. False (*The chlorophyll leaves the leaf of a deciduous tree before it is shed.*)
12. True

Short Answer

1. They release enzymes that decompose living and dead organisms, and then they absorb the nutrients.
2. Yeasts reproduce by first budding. Next the new cells grow out like bubbles from the parent cell. Then when they are big enough, they split off from the parent cell.
3. Algae are similar to other plants because they have chlorophyll & they make their own food by photosynthesis. Algae differ from other plants because they have no roots, leaves or flowers.
4. A fern grows by forming small buds at the base of the plant on the stem. Then these buds mature and unroll. Finally the leaflets unroll and grow to maturity quickly.
5. Possible answers include:
   - ✓ Roots (help to anchor the plant and absorb nutrients)
   - ✓ Stem (holds the plants up and serves as the transport system for the plant)
   - ✓ Leaves (absorb sunlight and produce energy for the plant through chlorophyll)
   - ✓ Flowers (reproductive part of the plant)
   - ✓ Seeds (contain the material necessary to grow a new plant)

6. Flower should be labeled as below.



7. Seeds can be dispersed by wind, water or animals.
8. Deciduous trees shed their leaves at certain times in the year, while evergreens keep their leaves all year long.

Biology for the Logic Stage

Student Guide

Biology Unit 2: Plants
Vocabulary Sheet

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

1. Fungi — _____

2. Spore — _____

3. Yeast — _____

4. Algae — _____

5. Lichen — _____

6. Photosynthesis — _____

7. Chlorophyll — _____

8. Frond — _____

9. Angiosperm — _____

Student Assignment Sheet Week 6
Fungi

Experiment: Can I grow mold?

Materials

- ✓ Bread
- ✓ Plastic bag
- ✓ Water

Procedure

1. Read the introduction to this experiment and then answer the question.
2. Moisten the bread by sprinkling it with water.
3. Place it in the plastic bag and set the bag in a warm, dark place.
4. Observe the bag daily. Be sure to take a picture or draw what you see on the experiment sheet.
5. After 5 days, make your final observations, finish the experiment sheet and throw the bread away. **DO NOT** open the plastic bag.

Vocabulary & Memory Work

- ☐ Vocabulary: fungi, spores, yeast
- ☐ Memory Work — Begin working on Types of Roots along with an example of each.
  1. Tap-root (Carrot)
  2. Fibrous root (Marigold)
  3. Adventitious root (Strawberry)
  4. Aerial root (Ivy)
  5. Propagative root (Cherry)

Sketch: Life cycle of a Mushroom

- 🖼 Label the following: Mushrooms start to form, mycelium grow, button elongates, outer skin splits and pores under cap are exposed to air, cap grows and pores shed their spores

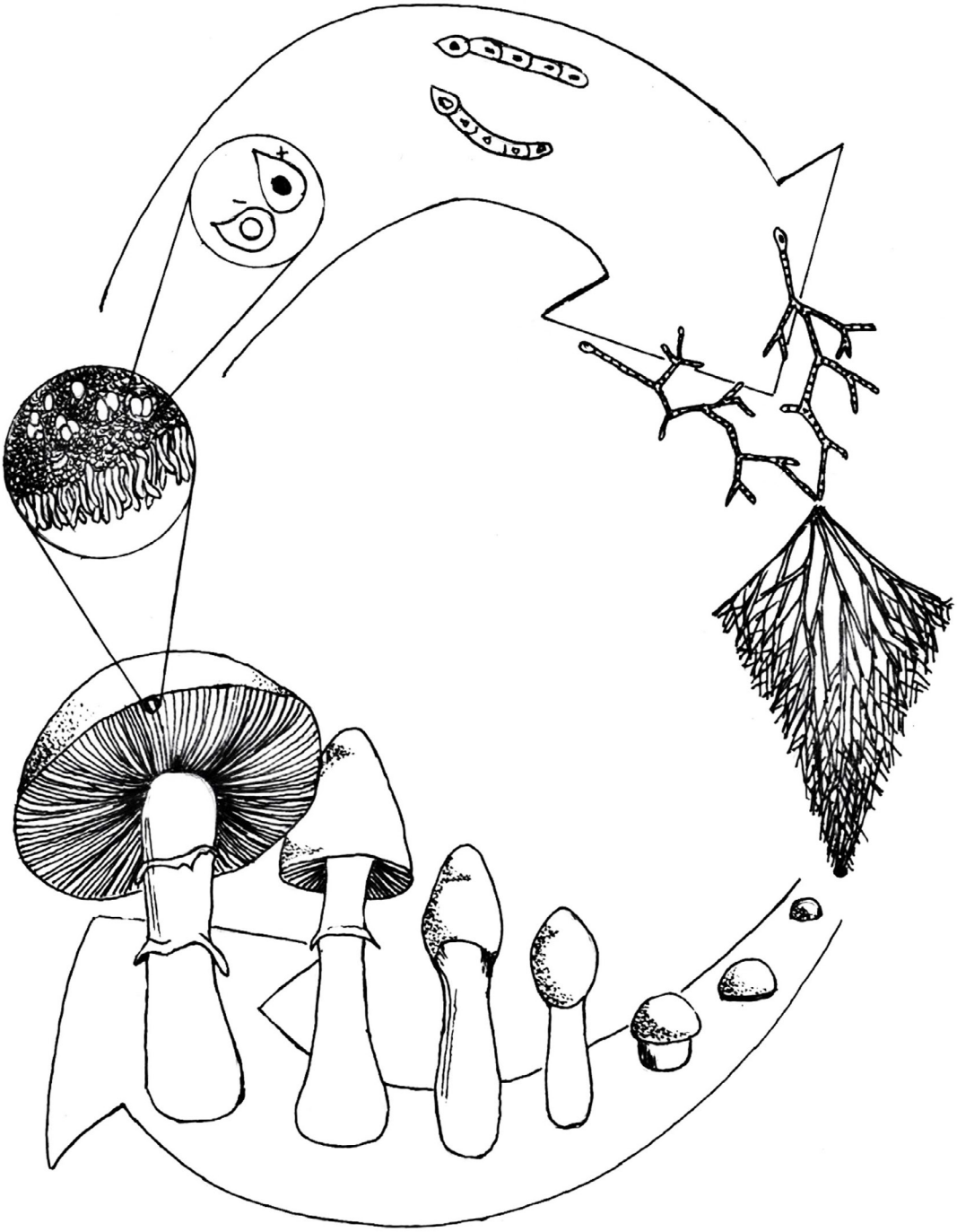
Writing

- Reading Assignment: *Encyclopedia of Nature* pp. 114-115 Fungi
- Additional Research Reading
  - 🕮 Fungi: UISE pp. 284-285
  - 🕮 Fungi & Lichens: KSE pg. 55

Dates to Enter

- 1588 — Giambattista della Porta first observes fungal spores.
- 1836 — English naturalists Miles Joseph Berkeley first used the word mycology to mean the study of fungi.
- 1928 — Alexander Fleming discovers penicillin.

Sketch Assignment Week 6



Experiment: Can I grow mold?

Introduction

Mold is neither a plant nor an animal. It is part of the Fungi Kingdom and is usually found in dark, damp places. Mold does not contain chlorophyll, so it cannot produce its own food from light like most other plants. Instead mold feeds on living or once living matter. In this experiment, you will see if you can grow mold using a piece of bread.

Hypothesis

Can I grow mold? Yes No

Materials

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Procedure

_____

_____

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Observations

Bread after Day 1	Bread after Day 2
Bread after Day 3	Bread after Day 4

Conclusion

Written Assignment Week 6

Title: _____

Written Assignment Week 6

Student Assignment Sheet Week 7
Simple Plants (Algae)

Experiment: Can I grow algae?

Materials

- ✓ Pond or aquarium water
- ✓ Small glass jar
- ✓ Eye dropper
- ✓ Microscope
- ✓ 2 Slides and cover slips

Procedure

1. Read the introduction to this experiment and then answer the question.
2. Collect some pond or aquarium water in a small glass jar.
3. Place a drop of water onto a slide and cover it with a cover slip, using the same method you learned in week one.
4. Look at it under the microscope using the 10x objective lens. Move the slide around slowly to see if you can find any green algae cells.
5. Set the jar out on a sunny window sill and observe what happens in the jar over 5 days.
6. After five days, look at the water under the microscope again using the same procedure you did in steps three and four. Then complete the experiment sheet.

Vocabulary & Memory Work

- ☐ Vocabulary: algae, lichen, photosynthesis
- ☐ Memory Work — Continue to work on the Types of Roots.

Sketch: Anatomy of an Bladder Wrack

- 🖼 Label the following: fronds, gas bladders, stalk

Writing

- ✍ Reading Assignment: *Encyclopedia of Nature* pp. 118-119 Algae & Lichens
- ✍ Additional Research Reading
  - 🕮 Photosynthesis: UISE pp. 264-265 OR UIDS pp. 254-255
  - 🕮 Photosynthesis: *Encyclopedia of Nature* pp. 24-25
  - 🕮 Water Plants: UISE pp. 280-281

Dates to Enter

- 🕒 2600 BC- 2000 BC — Ancient Egyptians used different colors of algae as eye make-up.
- 🕒 1811-1866 — William Harvey was the first to divide algae into four divisions based on their pigmentation.

Sketch Assignment Week 7

Experiment: Can I grow algae?

Introduction

Green alga is the most diverse category of algae. There are over 7000 different species that grow in many types of aquatic habitats. Green algae have chlorophyll which captures light and uses it to produce sugars for food. In this experiment, you will be attempting to grow green algae from either water from a pond or an aquarium.

Hypothesis

Can I grow algae? Yes No

Materials

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Procedure

_____

_____

_____

_____

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_____

Observations & Results

Water on Day 1	Water on Day 5

Conclusion

Written Assignment Week 7

Title: _____

Written Assignment Week 7

Student Assignment Sheet Week 8
Spore-Bearing Plants (Fern)

Experiment: Observation of a Fern

Materials

- ✓ Fern frond (with spores if possible)
- ✓ Magnifying glass
- ✓ Microscope
- ✓ Slide & cover slip

Procedure

1. Read the introduction to this experiment.
2. Observe the fern using your eyes and the magnifying glass, and then answer the questions on the experiment sheet.
3. Make a wet mount slide using the directions from the experiment in week one. Look at the slide using the 40x objective, then draw what you see on the experiment sheet.
4. Draw conclusions and complete the experiment sheet.

Vocabulary & Memory Work

- ☐ Vocabulary: chlorophyll, frond
- ☐ Memory Work — Continue to work on the Types of Roots.

Sketch: Life Cycle of a Fern

- 🖼 Label the following: mature plant produces sori which contain clusters of sporangia, sporangia release spores into the air, spores grow into the prothallus which produces the sex cells, the male and female sex cells fuse, the resulting cell grows into a fern plant

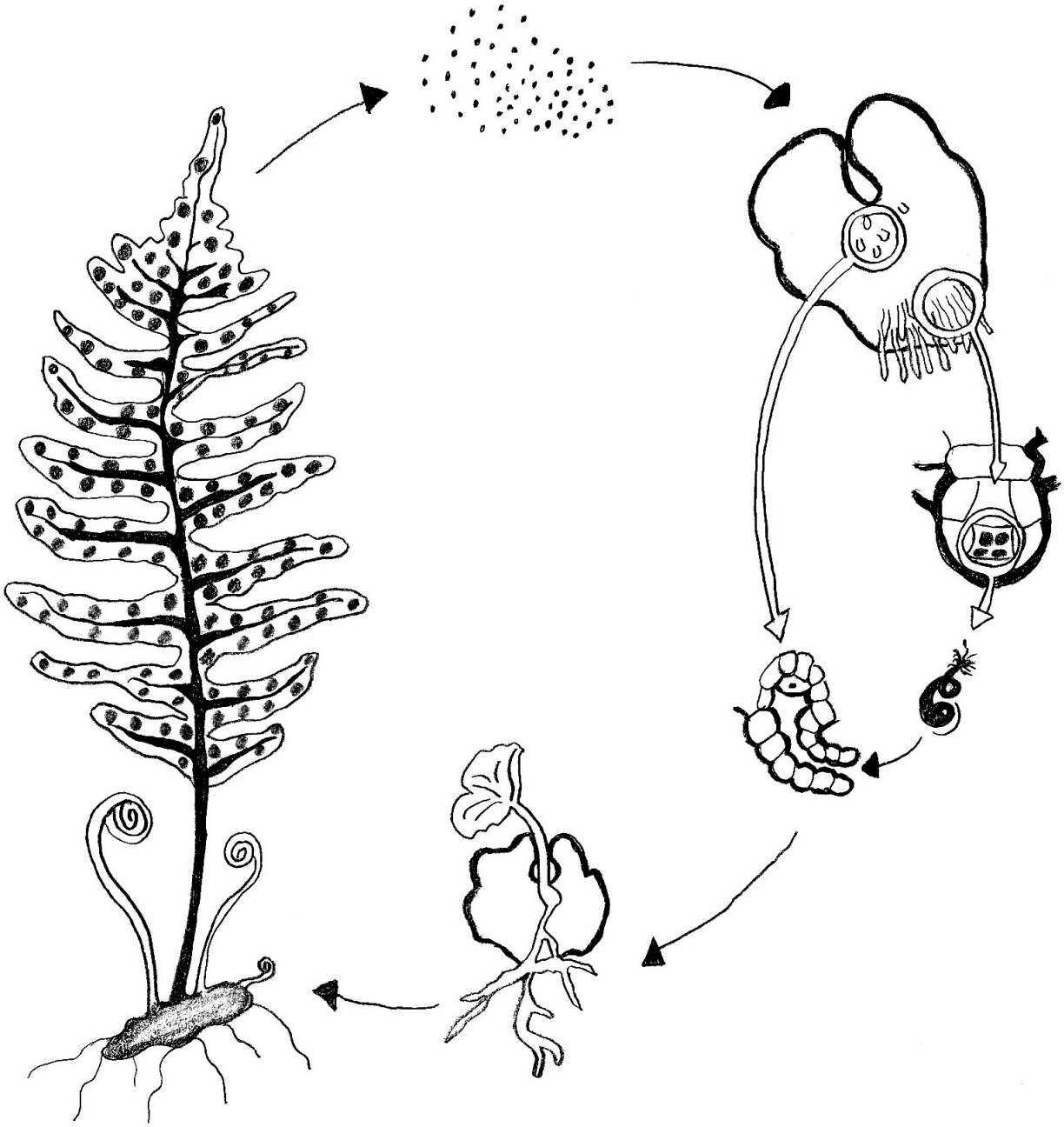
Writing

- Reading Assignment: *Encyclopedia of Nature* pp. 122-123 Ferns & Horsetails
- Additional Research Reading
  - 🕮 Flowerless Plants: UISE pp. 282-283 OR *Encyclopedia of Nature* pp. 116-117
  - 🕮 Non-flowering Plants: KSE pg. 58
  - 🕮 Leaves: UIDS pp. 248-250

Dates to Enter

- 🕒 1855 — Charles Kingsley coins the term Pteridomania or Fern Craze to describe the Victorian era craze of fern collecting and decorating with the fern motif in pottery and glass.

Sketch Assignment Week 8



Experiment: Observation of a Fern

Introduction

Ferns are primitive plants that are generally found in humid forests and near river banks. Ferns do not flower. They also release spores instead of seeds. In this experiment, you will examine and observe the structure of a fern.

Materials

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Procedure

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Observations & Results

How does the fern smell and feel?

_____

_____

_____

_____

Describe the basic structure of the fern.

How the fern looked under the magnifying glass	How the fern looked under the microscope

Conclusion

Written Assignment Week 8

Title: _____

Written Assignment Week 8