Illustrations for the Biological Sciences

Scientific illustrations are a great tool for keeping a record of your observations and helping you to remember the important features of an observed specimen because they require that you pay close attention to detail. Simply looking at specimens in a text – book or on a computer screen is less effective in terms of remembering and understanding what you observed.

Objectives: From this activity, you will demonstrate the proper use and handling of light microscopes, how to draw specimens for biological courses, and identify the key features of a specimen.

Directions: Go to http://microplants.zooniverse.org. Use this website and the images/prepared slides provided by your instructor to identify, sketch, and label the following structures: antheridia, archegonia, capsule, gametophyte, gemma, invulucre, median leaf, micro-leaf, protonema, rhizoid, seta/stalk, spores, sporophyte, stem, and thallus.

1. While carefully examining your specimen for important features, remember to only draw what you see and not what you think you should see.
2. Draw large, clear images only in pencil using distinct, single lines (no shading or sketching; only stippling).
3. All drawings must include the following:
    - Title that explains exactly what you are drawing (levels of classification TBD by instructor).
        - Kingdom: Plantae
          Phylum: Marchantiophyta
          Class: Jungermanniopsida
          Order: Jungermanniales
          Family: Jubulaceae
          Genus: Frullania
          Species: pycnantha
    - Labels are to the right of your drawing with straight lines that do not overlap.
    - Indicate the magnification at which the specimen was observed.
    - Include an annotation briefly describing what cannot be seen in the drawing, but was observed under the microscope (e.g. cells were stained blue).
    - Scale bar indicating the length and/or width of your specimen.
4. No more than two drawings per page.

Once you have finished drawing and labeling your specimen(s), fill in the comparison chart on the next page. List and describe the similarities and differences between magnification, species, their structures and ideal environments. In the last

column, create your own feature to compare (life cycle, size, scale/measurement, arrangement, etc.)

Comparison Chart

Specimen	Habitat	Structure	Function	

Vocabulary Check

Alteration of generations

Antheridia

Archegonia

Capsule

Gametophyte

Gemma

Invulucre

Median leaf

Micro-leaf

Protonema

Rhizoid

Seta/Stalk

Spores

Sporophyte

Stem

Thallus

Scientific Drawings : Biological Illustrations

Student Name: _____

CATEGORY	15 pts	10 pts	5 pts	0 pts
General Formatting	Unlined paper is used. The drawing is large enough to be clear (about 1/2 of a page of typing paper). Student name, class, and date are in the lower left corner. There is a figure caption that describes	Unlined paper is used. The drawing is large enough to be clear (about 1/2 of a page of typing paper). Student name, class, and date are in the lower left corner.	Unlined paper is used. The drawing is a little too large or a little too small. Student name, class, and date are in the lower left corner.	Lined paper is used AND/OR the drawing is much too small or much too large.
Accuracy	95% or more of the assigned structures are drawn accurately and are recognizable. All assigned structures are labeled accurately.	94-85% of the assigned structures are drawn accurately and are recognizable. All assigned structures are labeled accurately.	94-85% of the assigned structures are drawn accurately and are recognizable. 94-85% of the assigned structures are labeled accurately.	Less than 85% of the assigned structures are drawn AND/OR labeled accurately.
Drawing - details	All assigned details have been added. The details are clear and easy to identify.	Almost all assigned details (at least 85%) have been added. The details are clear and easy to identify.	Almost all assigned details (at least 85%) have been added. A few details are difficult to identify.	Fewer than 85% of the assigned details are present OR most details are difficult to identify.
Drawing - general	Lines are clear and not smudged. There are almost no erasures or stray marks on the paper. Color is used carefully to enhance the drawing. Stippling is used instead of shading. Overall,	There are a few erasures, smudged lines or stray marks on the paper, but they do not greatly detract from the drawing. Color is used carefully to enhance the drawing. Overall, the drawing	There are a few erasures, smudged lines or stray marks on the paper, which detract from the drawing OR color is not used carefully. Overall, the quality of the drawing is fair.	There are several erasures, smudged lines or stray marks on the paper, which detract from the drawing. Overall, the quality of the drawing is poor.
Knowledge Gained	When asked about 10 items in an unlabeled drawing of the same plant or animal, the student can identify all of them accurately.	When asked about 10 items in an unlabeled drawing of the same plant or animal, the student can identify 8-9 of them accurately.	When asked about 10 items in an unlabeled drawing of the same plant or animal, the student can identify 6-7 of them accurately.	When asked about 10 items in an unlabeled drawing of the same plant or animal, the student can identify 5 or less of them accurately.

Unit 1: Cell Structure Function

Science + Engineering Practices

1. What are the key features of an organism and why are they important to its survival?
2. Using visual aids, create a model to map out important features of an organism.
3. Develop a research - based writing strategy to investigates the similarities and differences between organisms.
4. Construct a representative model to explain and design solutions.
5. Engage in argument from evidence.
6. Obtain, evaluate, and communicate information.

Disciplinary Core Ideas

LS1: From Molecules to Organisms: Structures and Processes
• LS1A: Structure and Function
• LS1.B: Growth and Development of Organisms
• LS1.D: Informational Processing
HS-LS2 Ecosystems: Interactions, Energy, and Dynamics
ETS2: Links Among Engineering, Technology, Science, and Society
• ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World

Crosscutting Concepts

1. Patterns
2. Cause and effect: mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: flows, cycles, and conservation
6. Structure and function
7. Stability and change

NGSS - Content

HS-LS1 From Molecules to Organisms: Structures and Processes
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms

HS-LS2 Ecosystems: Interactions, Energy, And Dynamics
HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-ETS1 Engineering Design

Skills

11A Know and apply the concepts, principles, and processes of scientific inquiry.
11B Know and apply the concepts, principles, and processes of technological design.
13A Know and apply accepted practices of science.
13B Know and apply concepts that describe the interaction between science, technology, and society.

CCSS Outcome Statements: *Students will be able to…*

WHST.6-8.8 Ask questions to research relationships between species and structures
RST.6-8.7, MP.2 Develop and use models to demonstrate the size, structure, and functions of cells (be able to differentiate different types of cells)
RST.6-8.3, MP.5 Plan and carry out investigations using a microscope to observe, view, identify and classify various structures
RST.6-8.3, MP.5 Analyze and interpret data to reveal patterns in structures and functions of different types of cells (structure and function).
MP.5 Use mathematics and computational thinking to calculate the total magnifications of microscope lenses (scale, proportion, and quantity).
RST.6-8.7 Construct explanations in order to compare and contrast single cell organisms and multicellular organisms.
RST.6-8.1 Engage in argument from evidence to show that all living things are made up of cells.
RST.6-8.9 Obtain, evaluate, and communicate information to demonstrate an understanding that an organism is made up of many individual cells.
Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.
Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles and theories.
Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows— within and between systems at different scales.
New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology.