Grade 7
Science
Unit 3: Living Organisms

Time Frame: Approximately six weeks

Unit Description

This unit focus is on the life cycle of plants and animals, including humans, and on the comparison of complete and incomplete metamorphosis. Representative organ systems are explored. The unit concludes by introducing students to the development and use of dichotomous keys.

Student Understandings

Plants and animals go through defined stages of development. Students will explore metamorphosis in animals as a specific example and investigate life cycles of some plants. Evolutionary adaptations of each life form should be understood and observed by students as much as possible. In studying the characteristics of living organisms, students should recognize similarities and differences and be able to construct a dichotomous key for identification of species and defined groups.

Guiding Questions

1. Can students describe complete metamorphosis and incomplete metamorphosis, citing examples of each?
2. Can students describe and compare life cycles of selected plants and animals and compare these to the human life cycle?
3. Can students identify major plant structures and describe their functions?
4. Can students identify major organs in the human body, relate their structure to their function, and describe the interaction with the system?
5. Can students classify organisms using a dichotomous key?

Unit 3 Grade-Level Expectations (GLEs)

GLE #	GLE Text and Benchmarks
Science as Inquiry	
Note: The following Science as Inquiry GLEs are embedded in the suggested activities for this unit. Other activities incorporated by teachers may result in additional SI GLEs being addressed during instruction on the Living Organisms unit.	
3.	Use a variety of sources to answer questions (SI-M-A1)

GLE #	GLE Text and Benchmarks
7.	Record observations using methods that complement investigations (SI-M-A3)
10.	Identify the difference between description and explanation (SI-M-A4)
11.	Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)
12.	Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
16.	Use evidence to make inferences and predict trends (SI-M-A5)
18.	Identify faulty reasoning and statements that misinterpret or are not supported by the evidence (SI-M-A6)
19.	Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)
20.	Write clear, step-by-step instructions that others can follow to carry out procedures or conduct investigations (SI-M-A7)
21.	Distinguish between *observations* and *inferences* (SI-M-A7)
22.	Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)
23.	Use relevant safety procedures and equipment to conduct scientific investigations (SI-M-A8)
24.	Provide appropriate care and utilize safe practices and ethical treatment when animals are involved in scientific field and laboratory research (SI-M-A8)
26.	Use and describe alternate methods for investigating different types of testable questions (SI-M-B2)
28.	Recognize that investigations generally begin with a review of the work of others (SI-M-B2)
Life Science	
5.	Compare complete and incomplete metamorphosis in insects (e.g., butterflies, mealworms, grasshoppers) (LS-M-A3)
6.	Compare the life cycles of a variety of organisms, including non-flowering and flowering plants, reptiles, birds, amphibians, and mammals (LS-M-A3)
9.	Relate structural features of organs to their functions in major systems (LS-M-A5)
10.	Describe the way major organ systems in the human body interact to sustain life (LS-M-A5)
11.	Describe the growth and development of humans from infancy to old age (LS-M-A6)
23.	Classify organisms based on structural characteristics, using a dichotomous key (LS-M-C1)

Sample Activities

Activity 1: Metamorphosis Observation (SI GLEs: 10, 16, 18, 21, 23, 24, 28; LS GLE: 5, 6)

Materials List**:** index cards or thick paper, sentence strips or bulletin board paper, pictures of animals in various stages of complete and incomplete metamorphosis, vials, various organisms for classroom study and food for each, hand lens, fruit flies, frogs, moths, mealworms, butterflies, Internet access, research tools (library access, trade books), Metamorphosis Observations BLM (one per group)

Safety Note: Students should also be given the opportunity to identify the safety precautions that they should use in both Part A and Part B; it is incumbent upon the teacher, however, to monitor this with students and to be sure that they follow laboratory safety procedures when handling and caring for living organisms.

Part A
To define *metamorphosis*, begin by providing students with this short dialogue: There is a new hair salon opening up in the local mall and the name of it is "Metamorphosis." How does this name relate to what happens at a salon? How could this possibly relate to the metamorphosis of organisms? Create a card sort by displaying pictures of organisms in various stages of life cycles. Card sorts can be created by attaching pictures of animals in various stages of incomplete and complete metamorphosis on thick paper or index cards. Grouping students, and providing each group a different organism, can allow groups to compare descriptions. Possible organisms to display for complete metamorphosis include butterflies, moths, and frogs; for incomplete metamorphosis, dragonflies, grasshoppers, and crawfish. Such pictures may be obtained from textbooks, trade books, or at the following web site: http://www.enchantedlearning.com/coloring/lifecycles.shtml. As students study the pictures, ask them to write an explanation about what they observe, describing how each stage is different from the previous one based upon their card sort pictures. Be sure that students can differentiate between an *explanation* and a *description*. Provide students the opportunity to carousal around the classroom and observe pictures and explanations of other groups. Students should determine if metamorphosis has occurred, based on the definition plus visual and structural changes. Provide students with a picture or key displaying the correct order of metamorphosis for their organism. Using this information, students should re-evaluate their decisions. Discuss with students how minimal observations can lead to faulty reasoning.

Part B
Note: Provide and model appropriate care and utilize safe practices and ethical treatment when working with living organisms

An organism that is at the egg stage of metamorphosis should be selected for this observational investigation. Possible organisms to use include fruit flies, frogs, moths, mealworms, monarch butterflies, etc. (Science supply companies, pet stores, and bait shops are possible sources of organisms.).

Provide student groups with the selected organism at the egg stage of metamorphosis, along with appropriate food. The organism should be contained in a vial or other appropriate container, based upon the type of organism. Ask students to infer if the metamorphosis will be complete or incomplete and to predict the next stage, based upon their current knowledge. Instruct students to observe their organism every day for two weeks and record their observations and predictions in their science *learning logs, (*view literacy strategy descriptions). Science *learning logs* are student created booklets where students can record information. Data should include drawings representing the stages they observe. Answer questions to help explain their observations such as What type of metamorphosis is occurring? What observable structural changes can be seen? How long did the organism stay at each stage before the structural change occurred? Students should use their observations, descriptions, and explanations to make a data table. In two weeks, refer students to their previous prediction about the stages of metamorphosis and allow them to determine how accurate their predictions were and collect their observational data.

During the observation period, students should research information about their specific organism. They should try to find answers to such questions as What is its natural habitat? Where do females normally lay their eggs? How many eggs do they usually lay? What is the life expectancy? What are its predators? What do they feed on?

Place students in small groups and provide each student with a copy of Metamorphosis Observation BLM, sentence strips or strips of bulletin board paper. Ask the members of the group to create a science *story chain* (view literacy strategy descriptions) using incomplete and complete metamorphosis as the theme. A *story chain* can be created by allowing a member within the group to initiate the story, the next person adds a second line, and the next person adds the third line, etc. until the story has been completed. A sample story chain could begin by asking students to explain what happens after frog eggs are laid in water. The next student could address what happens after the eggs hatch. The next student could discuss the formation of gills. This process should continue through all the phases of metamorphosis. All group members should be prepared to revise the story based on the last student's input as to whether it was clear or not. Each group should be allowed to discuss their story chain before the entire class.

Part C
Ask students to think about how a scientist would find out if someone else had already discovered the answer to a question that he/she had or if someone was also working on a hypothesis that he/she was trying to prove. Students should be led to the fact that scientists usually study and review the work of other scientists before beginning their own investigations. Ask students why this would be important. Provide students with an article about an organism that undergoes metamorphosis written by a scientist. There are many online science publications that are suitable for this grade level in addition to ones that the school library might have on their shelves. See suggested links below:
http://cnnstudentnews.cnn.com/2002/fyi/news/03/19/ladybugs/
http://www.sciencedaily.com/releases/2006/03/060320214642.htm
http://www.sciencedaily.com/releases/2008/01/080117201947.htm
http://news.nationalgeographic.com/news/2006/09/060905-crickets_2.html

Place students in small groups and provide each group access to the article or text and an index card containing two questions. Each group should receive a different set.

- After the students have read the article and answered the questions within their group, explain that they have become the experts that will provide answers to questions from their peers. Each group will become a *professor-know-it-all* (view literacy strategy descriptions) for the questions that they have received. This strategy holds students responsible for presenting "expert" information to their peers based on what they have learned through their reading. The *professor-know-it-all* groups will stand before the class and provide answers to the questions they have prepared, for example
- What type of organism is being studied?
- What type of metamorphosis does the organism complete?
- Describe the focus of the article.
- Does the article describe some new information about the organism that was previously not known? If so, what was the information?
- What type of scientist completed the research?

A year long project that would be extremely thought provoking for students is to participate in the global study of wildlife migration of the Monarch butterfly. See the following website for details: http://www.learner.org/jnorth.

Activity 2: Life Cycles of Organisms (SI GLEs: 21, 23, 24, 26; LS GLEs: 5, 6, 11)

Materials List: pictures of human and animal life cycles, aquarium, life cycle DVD/video, flowering plants seeds, non-flowering plants seeds, potting soil and container, water source, mealworms, bran, slices of raw potato or apples, jar with lid, fertilized frog and/or chicken eggs, incubator

Provide and model appropriate care and utilize safe practices and ethical treatment when working with living organisms. Where materials are available, students may assist in setting up several learning centers for life cycle observations. Suggestions for life cycle centers might include, but are not limited to the following:

- Grow flowering plants
- Grow non-flowering plants
- Set up an aquarium for raising brine shrimp (sea monkeys)
- Observe mealworms in a capped jar with bran and a slice of raw potato or apple
- Observe fertilized frog eggs in an aquarium
- Incubate fertilized chicken eggs
- Watch a segment of a DVD/video of the life cycle of a mammal such as a kitten, puppy, calf, etc. (Make sure the material is appropriate for the age group. Obtaining parental permission is advised.)
- Observe illustrations of the stages in the human life cycle and describe observed changes at each stage, identifying the secondary sex traits

(The life cycle of some organisms will require more than the allotted six-week time requirement.) Identify and discuss alternate methods that may be used for investigating different types of testable questions.

If students assist in setting up any of the following activities, then they should write clear step-by-step procedures that others can follow to recreate their assigned learning center: growing flowering plants and/or non-flowering plants, setting up an aquarium to observe frog eggs, and incubating fertilized eggs.

Have students individually predict which organisms will have a complete and incomplete metamorphosis and explain their reasoning. As the organisms complete their life cycles, students will individually observe and record their findings, including drawings at each stage. The drawing should include a description and an explanation of each stage. Students should also complete an essay that summarizes their observations, comparing the similarities and differences noted, in addition to their inferences about developments during the life cycle of organisms studied.

If the materials are not available, provide students pictures of life cycles and allow them to provide an explanation of each stage. Pictures can be obtained at www.enchantedlearning.com/coloring/lifecycles.shtml.

Through guided questions, have students discuss stages of development of humans, including descriptions of growth and development from infancy to old age. Students should compare the human life cycle to that of another organism previously studied. Identify secondary sex characteristics that are distinguishable for men and women, such as voice changing, rapid growth, breast developing, etc.

Activity 3: Organs and Systems (SI GLEs: 10, 16, 19; LS GLEs: 9, 10)

Materials List: information for research on the major body systems, science learning logs

Building on knowledge students acquired in early grades and through current readings and instruction, assign students to groups to complete a group jigsaw of major human body systems and their organs. This jigsaw study will go for six rounds to include the circulatory, digestive, skeletal, endocrine, urinary, and respiratory systems. The class will be divided into home groups of three. Each student will also be part of a *professor-know it-all (*view literacy strategy descriptions) group for a particular area of study of the major systems. This strategy can be completed by allowing students to review the content covered to become the experts, and answers questions from their peers. The *professor know-it-all* groups are

1. Structure and Function—these experts will be responsible for knowing the specific organs that make up the system (anatomy) and the functions of the various organs (physiology). (Two students per home group will be part of this expert group: one to cover structure and one to cover function.)

2. Dysfunctions—these experts will identify and explain disorders associated with the system including external factors, genetics, and communicable/noncommunicable diseases and describe possible health effects.
3. Interaction—these experts will describe interactions between their assigned system and other systems.

Students will research together and develop a presentation in their expert group; then they will present information to the others in their home group. Students should create science *learning logs* (view literacy strategy descriptions) to record their information. *Learning logs* are a place for students to record observations, ideas, comments, and questions that they may have about the topic. Written descriptions, explanations, and diagrams should accompany their presentations. Be sure that students are able to differentiate between an *explanation* and a *description*. Have all groups rotate through all designated body systems.

Have students describe some of the movements they completed to get ready for school. Listing each task separately, students should describe the body part(s) and region needed to accomplish it. Remind students to consider the involuntary movements that occurred such as blood flowing, oxygen exchange, and some nerve responses. Using their list, students should then classify the body parts/regions into tissues, organs, and organ systems.

Activity 4: Plant Tissues (SI GLEs: 7, 11, 12, 16, 22, 23; LS GLE: 9)

Materials List**:** celery**,** hand lens, blade, two clear plastic cups per group, water, food coloring, science learning logs, ruler (one per group)

Safety Note: *Be sure that students identify and describe appropriate safety measures for this simple dissection. Review laboratory dress code; ensure all students wear appropriate clothing and protective eyewear. Review laboratory safety rules when using sharp instruments. Handle all sharp instruments such as scalpels or razor blades with extreme care. Remind students: Never cut material toward you; cut away from you. Notify your teacher immediately if you or another student is cut.*

Demonstrate the complete process following all safety procedures prior to allowing students to work individually.

Use questions or a pretest to determine students' prior knowledge of plant organs, roots, stems, flowers, and leaves. For an introduction to vascular tissue in the stalk of plants, have pairs of students take celery stalks and make a lengthwise cut three quarters of the way up the stalk. Instruct them to prepare two clear plastic glasses of water and color the water two different colors using food coloring. Have them place their containers of water side by side and place half the celery stalk in one container and half in the second container. Instruct them to write a prediction about what they think will happen. Instruct students to record observations in their science *learning logs* (view literacy strategy descriptions) after they initially set up and again after twenty-four hours. Science *learning logs* are student created booklets where students can record information. Ask students to write conclusions.

Introduce plant vascular tissue by comparing it to arteries and veins in animal circulatory systems. Provide diagrams and instruction as needed on the location and functions of the plant structures: xylem, phloem, vascular cambium, stomata, root hairs, and flower components. Allow students to compare the diagrams to those of the celery stalk that was placed in the container.

Conclude with a dissection lab of the celery plant, in which students use blades and hand lenses to dissect, observe and measure stalk components. Students should sketch or diagram the parts identified and explain the function of each. Use the data obtained to describe experimental results.

Activity 5: Classification (SI GLEs: 19, 20; LS GLE: 23)

Materials List: online resources; sample dichotomous keys; sample items to classify: collection of leaves, beans, buttons, building blocks, or pasta; Internet access (optional)

As an introduction to dichotomous keys, the students should create a class key based on their shoes. Each student should place one of his/her shoes in the front of the classroom. Then as a class, separate the shoes according to characteristics. Classification characteristics might include laces vs. no laces, rubber sole vs. non-rubber sole, white vs. non-white, etc. (more characteristics can also be created according to the shoes available). The descriptions should be placed on the board while the shoes are being separated. Once all shoes have been separated, use the characteristics identified to find one type of shoe.

Provide students with pictures of organisms, leaves, or common specimens and selected dichotomous keys. Such keys can be found in textbooks, online, or in field guides. Have students identify the organisms by their common and scientific names using the keys provided. Where technology is available allow students to complete interactive dichotomous keys available online.

Upon discussion of how to interpret sample dichotomous keys, students will work in pairs to create their own key based on structural characteristics for one of the following: an aquatic animal or plant, pine or other tree, or an insect.

Activity 6: Kingdoms and Phyla (SI GLEs: 3, 7; LS GLE: 23)

Materials List: Biological Classification BLM (teacher use), large paper

Introduce the activity by providing students access to a copy of the completed Biological Classification BLM, which utilizes *split-page notetaking* (view literacy strategy descriptions). The names and a short description of each organizational level have been provided; students should use this example to create their own *split-page notetaking* sheet for the remaining kingdoms as the information is introduced. Information such as pictures should be added to

ensure a greater understanding. The purpose of the *split-page notetaking* sheet is to allow students to take notes in a more organized format. The *split-page notetaking* sheet is created by drawing a line from top to bottom, approximately two to three inches from the left edge on a sheet of notepaper. Students should try to split the page into one third and two thirds. Once notes are completed, demonstrate for students how to use them for review by covering one column and using the other to prompt recall of the covered information. Also, allow students to quiz each other over the content of their notes in preparation for tests and other class activities.

Instruct students on the traits/characteristics of the kingdoms prior to engaging in the activity. Play *What Am I*? by displaying pictures, specimens, or diagrams of a selection of different organisms and then have students classify each example by its kingdom and then explain why they chose the arrangement. Provide instruction on the seven levels of biological classification and the meaning of *each* level.

Have students work in small groups or pairs to investigate and develop flip charts (cards), mobiles, pamphlets, or presentations that include the names, traits, and drawings of representative organisms for one phylum. Each group should be assigned to a specific phyla and present this information to the class.

After examining each classification group, conduct a review game or lab using the information from the students' *split-page notes* in which students match descriptions, specimens, or illustrations with the correct phylum or order. Explore the next group of organisms and follow it with a review game or lab. Have students construct a flow chart classifying organisms into their proper organizational level.

Sample Assessments

General Guidelines

Assessment will be based on teacher observation/checklist notes of student participation in unit activities, the extent of successful accomplishment of tasks, and the degree of accuracy of oral and written descriptions/responses. Journal entries provide reflective assessment of class discussions and laboratory experiences. Performance-based assessment should be used to evaluate inquiry and laboratory skills. All student-generated work, such as drawings, data collection charts, models, etc., may be incorporated into a portfolio assessment system.

- Students should be monitored throughout the work on all activities.
- All student-developed products should be evaluated as the unit continues.
- When possible, students should assist in developing any rubrics that will be used and should be provided with the rubric during task directions.

General Assessments

- The student will add to a journal the metamorphic observation of a selected organism.
- The student will create a display and presentation of a local habitat.
- The student will create a display and presentation of the life cycle of an organism.
- The student will write a laboratory report on the dissection of a plant.
- The student will create a flip chart (cards), mobile, pamphlet, or presentation that includes the name, trait, and representative organisms from a major phylum in the plant kingdom, an invertebrate phylum of the animal kingdom, and a major order of a vertebrate of the animal kingdom.

Activity-Specific Assessments

- Activity 1: Provide students with un-labeled drawings of animals that exhibit complete and incomplete metamorphosis. Ask students to number the drawing in the correct order and identify the type of metamorphosis observed.

- Activity 2: Place the name of an organism that was discussed in class on the board and instruct students to develop a life cycle display, poem, song, rap, or presentation. Check student assignments for accuracy

- Activity 5: Given a dichotomous key and illustrations of leaves, students will identify the leaf using the common and scientific name.

Resources

- *The Blossoming of Flower Power.* New York Times lesson. Available online at http://www.nytimes.com/learning/teachers/lessons/19990803tuesday.html
- *Plant Parts and life cycle.* Available online at http://www.mbgnet.net/bioplants/parts.html
- *Butterfly Information and Life Cycle*. Available online at http://www.monarchwatch.org/biology/index.htm
- *GEMS: Schoolyard Ecology*.
- "Geographic Distribution Habitats: Ladybugs." *CNN Student News*. Available online at http://cnnstudentnews.cnn.com/2002/fyi/news/03/19/ladybugs/
- *How Stuff Works: How Muscles Work*. Available online at http://science.howstuffworks.com/muscle.htm
- *Inner Learning Online: Human Body Systems*. Available at http://www.innerbody.com
- *Education of a Halfshell: Using a Dichotomous Key.* Available at http://lamer.lsu.edu/classroom/edonahalfshell/dicotkey1.htm