



Lesson 1: Characteristics of Living Things

Let's begin by taking a look at the word "biology." The word "biology" is built from two parts: bio- and -ology. Bio- comes from the Latin term **bios** which means **life**. The **-ology** portion of biology refers to **the study of**. If we put the two parts together we get that **biology is the study of life**. There are many other terms which end in -ology. You might know the word geology which is the study of geos or the earth. Another familiar "-ology term" is entomology which is the study of insects. Archeology is the study of human artifacts. As we progress through this biology course, we will introduce you to many fields of studies related to biology. Knowing the scientific names given to these studies becomes quite handy, especially when dealing with medical terms such as hematology (the study of blood) or oncology (the study of tumors or cancer). For now, we'll concentrate on biology, the study of life.

bios- = life

-ology = study of

biology = study of life

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If our goal is to study living things, first we need to establish exactly what makes something a living thing. How do you know when something is alive or not alive? If you think about things in your home for example, how do you know that your kitchen table is not alive, but your pet goldfish is alive? Or how do you know that the sidewalk outside your house is not alive, but the flowers growing along side it are alive?

Most likely the first idea that comes to mind when determining whether something is alive or not is the fact that living things can move. Cats pounce, birds fly, people walk and run, fish swim and tiny worms wiggle. Yes, being able to move does give you an indication that the object in question is indeed alive. But, how does something like a plant—which you would say is alive—move? You might say, well, it moves when the wind blows. But a flag also moves when the wind blows and a flag is not a living thing. So, while plants are alive and, yes, plants move, their movement is not as visible to the observer as the movement of some other living things.

Have you ever noticed how a plant can adjust its position to catch more sunlight? If you live



in a farming area or have a vegetable garden, you may be familiar with sunflowers. The flower of a sunflower moves throughout the day in an effort to gain the most exposure to the sun. Plants also move water from the soil and food they make in their leaves to be stored in their seeds or down in their roots. So, yes, plants do meet the requirement of movement to be considered alive. Correspondingly, it is highly unlikely that once you place your non-living kitchen table in your kitchen you will

find it sitting in a different location when you return later. **Living things move.** Non-living things (for the most part) do not move on their own.

Living things move.

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Can you think of another thing that living things can do, but non-living things cannot? How about the idea that living things can have babies? This idea, like the idea of movement, is a readily acceptable idea for differentiating between things that are alive and those that are not alive. Things that are living make more living things: cows have calves, pigs have piglets and people have infants. Daisies and zinnias make seeds. The mold that grows on old food in your refrigerator makes spores which can produce more mold. Even the tiniest bacteria and viruses reproduce and, to our dismay, can do so at amazing rates. **Living things reproduce.** And, once again, your kitchen table, which is not alive, cannot make more kitchen tables!

Living things reproduce.

So far, when determining whether something is living or not, we've said that living things move (on their own) and reproduce. Let's continue. For the third characteristic of a living thing, consider this question: what happens to you about 7 o'clock each morning, again at about noon and then sometime around 6 o'clock each evening? Got it? Sure, you get hungry, right? You find yourself wandering into the kitchen or thinking about what you can get yourself to satisfy that feeling of hunger. Likewise, your pets get hungry and need to be fed. On a less appetizing note, the little parasitic worms living *inside* your pets get hungry, too! Whether large or small, living things need to eat or, more precisely, **living things need a source of food or energy.**

This is one characteristic of living things in which plants have a big advantage over animals and humans. Plants have the ability to make their own food. When was the last time you saw some tulips or maple trees shopping down at the local supermarket? While plants may not require a food source outside themselves, they do require a source of energy (the sun in most cases) to make their food. Without sunlight, most plants simply cannot survive. We'll discuss this process, known as photosynthesis, in greater detail in a later lesson.

Living things need a source of food or energy.

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So far, we've said that living things move, living things reproduce and living things require a source of energy. A fourth idea to help us differentiate between living and non-living things is the fact that living things grow. A baby chick, while cute and fuzzy when a few days old, soon becomes a straggly "teenager" chicken just a few weeks later. A puppy grows into a dog and a kitten into a cat. You outgrow your clothes. The zinnia seeds you plant sprout and grow into a flowering bush. The mold on the old food in your refrigerator spreads all across the food and sometimes even up the sides of the container. **Living things grow and develop.** Things that are not alive show no signs of growing nor developing.

Living things grow and develop.

Let's pause and review. We've described four ideas that help us differentiate living things from non-living things: living things move, living things reproduce, living things require a food or energy source and living things grow and develop. There is one other thing that living things do that non-living things do not.

To demonstrate this fifth characteristic of living things, try the following activity. Perhaps you are sitting in a chair or at a desk as you are reading this book. Carefully and quietly, stand up and walk around behind the chair. Sneak up to your chair very quietly and when really close, shout, "BOO!" Watch the results. What? Nothing happens? Okay, let's try this again, but this time, choose your Mom, Dad, brother, sister or classmate and ask him or her to sit in the chair. Repeat the procedure you did with your empty chair. Go ahead—you have permission from your science teacher to conduct this "important" first lab activity. Write or draw a picture of the results of your experiment here:

Now, unless the person on which you chose to conduct your lab was very asleep or unconscious, it should be apparent that living things respond to things in their environment. The chair, being non-living, did absolutely nothing when you attempted to surprise it. However, the

person you chose to surprise probably not only showed you that **living things respond to their environment**, but may have shown you that living things move, too! Good review, right? So, yes, living things respond to their environment. In this case, environment means everything found surrounding that living thing.

Again, you might say, “It’s easy to see something large like an animal, for example, responding to its environment. What about plants?” Think about a houseplant that may have been forgotten about for several weeks. No one has watered or cared for it. What happens to it? Do its leaves begin to droop and become a different color? Does it begin to drop some of its leaves? How might this plant respond once it gets watered and cared for again? Sometimes the plant returns to its prior condition, sometimes, as you may be aware, it does not. The plant has responded to a change in its environment. In this case, the lack of water caused many changes in the plant (drooping and changing of color of its leaves). Then, when the water returned, again (hopefully!) the plant responded.

Likewise, you may have noticed that some houseplants will grow toward the sunlight coming in from a window. Recall our discussion of the sunflower as it moves its flower and leaves to face the sun. These plants are responding to their environment.

Living things respond to their environment.

This brings us to the final topic for this first lesson and that is the idea of death. While not generally thought of as a pleasant topic, the very fact that living things are indeed alive requires that we must accept the fact that life does eventually stop for all living things. By some means or another, the essence that we call life *does* leave the once-living organism. We snuck in a new term there: organism. Organism just means one complete living thing. Death eventually comes to all organisms.

If we look back at the five characteristics we presented in this lesson that we use to differentiate between living and non-living things (movement, reproduction, requirement of a food or energy source and response to one’s environment), we realize that these features are the very characteristics we use to determine if, indeed, life has left that living thing. We look for movement and response to our voice or actions. We watch for breathing, which, as we will

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learn later on, is a major factor in how living things produce energy. And then, with a living thing that is more simple like a plant or bacteria, for example, we note that it is no longer creating new growth or dividing into larger colonies. It is when these forms of evidence are no longer present we deem the once-living organism dead.

In the lessons that follow, we will examine in greater detail how life “happens” in living things. We will begin on the very, very small level and then progress to understand how complex organisms such as you and I carry on our lives. Life itself is truly an amazing thing to ponder.

Let’s stop now and review the ideas we discussed in this first lesson. We outlined five characteristics of living things. We said that living things:

- Move
- Reproduce
- Require a source of food or energy
- Grow and develop
- Respond to their environment.

These features are common to all living things and it is the absence of these five characteristics that tells us that life has ceased for that organism. Turn the page now to view the Lesson 1 Lab Activity.

Living things move, reproduce, require a source of energy, grow and develop and respond to their environment

Lesson 1 Lab Activity: Growing a Pet Potato Plant

IMPORTANT: READ ALL OF THESE INSTRUCTIONS FIRST BEFORE BEGINNING!

The best way to begin to appreciate the five features common to living things is to observe a living thing first-hand. A great way to do this is to grow a pet potato plant. Items you'll need include:

- Flower pot or bucket or tub. It should be able to hold approximately one cubic foot (or more) of potting soil.
- Potting soil
- Small potato
- Magnifying glass

Procedure:

1. Prepare the pot for your pet potato plant

Begin by preparing your flower pot, bucket or tub for your potato plant. Whichever container you choose to use, make sure that it has holes in the bottom so that excess water can readily drain from the pot. It is also a good idea to place a container beneath your pot to catch this water so that it doesn't harm the surface on which it is placed.

2. Add potting soil to your pot.

Next, take some of the potting soil and place it into the pot. Continue to fill the pot about 3/4ths full. We strongly suggest that you **do not** use soil or dirt directly from your yard or garden. Potting soil, purchased from your local garden center or discount store works much better for this activity.

3. Observe the potato

Take your potato and make some observations. Look closely at the surface for some indented places where you might see a small white sprout. This little sprout can be very tiny on some potatoes and large and robust on others depending upon where your potato has been stored. Be careful not to disturb this little sprout or eye as is it called by potato farmers or gardeners. If you find any soft or discolored spots on your potato consider using another one. These soft spots are locations where the potato has begun to be invaded by other tiny living creatures, most likely fungi and bacteria that are

working to decompose (or rot!) the potato. If you have access to a digital camera, take a photo of your potato. A close-up shot of the eye would be ideal. As a reference, place a coin next to the eye of the potato as you take the photo.

The small white bump on this potato is the eye of the potato. There may be more than one present. Each can develop into a “new” potato plant.



This seed potato has been allowed to set out longer before being planted. Note how small roots have begun to form. It is ready to be planted!



4. Once you’ve located an eye on your potato, gently place the potato down into the soil. It does not matter how you place the potato into the soil. The roots will grow downward and the stems will grow upward. Fill the remainder of the pot with potting soil and gently press the soil down. Do not pack the soil tightly.

4. Water the potato

Using tap water, gently pour water down through the top of your pot until you see water escaping from the holes underneath. Once all of the soil has been moistened, stop pouring in water. Set your potato and pot in sunny window. You can grow your potato outdoors as long as the weather remains well above freezing. Note that a frost can be harmful to your potato plant.

6. Begin your potato journal

Create a journal to record the daily observations you make of your potato plant. Begin your first entry by telling how you prepared the potato pot. List all of the steps you followed. Then list the observations you made of the potato. Tell about the eyes and how many of them you found. If you were able to make photographs of your potato, include those in this first entry. Tell how you planted the potato. Finally, tell how you watered the potato. Visit your potato everyday and continue to make observations. Record your observations in your journal. You may not see much happening right away, but continue to observe the pot everyday.

Notes about growing potatoes: If you've never grown potatoes before, you may have been somewhat surprised that most potatoes are grown from potatoes themselves and not seeds. Potato farmers and gardeners purchase what are called "seed potatoes" which are small potatoes chosen specifically for growing another crop of potatoes. Some farmers plant these small potatoes whole while other may cut them into pieces with each piece having at least one eye present. This process of creating a new plant from part of the old "mother" plant is called vegetative propagation which is a form of reproduction where only one parent is involved. We'll discuss this means of reproduction in greater detail in Lesson 12.

6. Care for your pet potato plant.

There are two important things you must provide for your potato in order for it to grow happily: constant supply of sunshine and constant supply of water. A sunny window sill or outside porch where your potato can receive full sunlight is an ideal location for your potato plant. As we discussed earlier, potato plants are not hardy in cold weather and can be killed if left outdoors at temperatures near or below freezing.

An optional thing you can do for your pet potato plant is to provide it with some nutrients in the

form of plant food or fertilizer. We recommend you use a plant food labeled for house plants such as Miracle Gro plant food. Be sure to follow the plant food label directions carefully and store the fertilizer away from small children or pets.

Continue making observations of your potato plant on a daily basis. Note when things appear or disappear. Use a ruler to make measurements. Continue taking photographs of all parts of your plant. Remember to use a coin as a size reference in your photos. Take good care of it. It may reward you later.

Here are some things you might expect to see with your potato:

- Flower buds and blooms may appear a few weeks after the plant has begun to grow. Examine them closely and take close-up photographs if possible.
- If your plant grows tall and spindly, it may be seeking more light. Try moving it to a sunnier location.
- Eventually, the leaves of your plant will begin to lose their deep green color as the plant moves more and more of its nutrients to the newly forming potatoes beneath the soil level. The plant will eventually begin to wither and appear to die. However, it is only following its normal life cycle and is relocating itself beneath the soil surface. Continue to water the plant as you have been throughout its growth period.
- When the plant appears to be almost “dead,” you can think about digging for your potatoes. If indoors, take the pot outside. Pull the plant from the soil. Depending upon the success of your growing attempts, you should find quite an assortment of potatoes clinging to the roots of your plant. Some will be very small yet, while some may be quite large. See if you can find your original “seed” potato. What does it look like? Take a photo of your potato crop. Break them free from the roots and wash them well. Count how many your plant produced. Weigh them if you have a scale. At this point, your potatoes are referred to as “new” potatoes and they can be cooked without peeling. Boiling them and then serving with butter and a sprinkle of salt is very delicious. Share with your family.

Name _____ Date _____

Lesson 1

Practice Page 1

Instructions: Fill in the blank with the appropriate word. Refer back to the text portion of the lesson for help.

1. The term biology is derived from two words: _____ which means life and _____ which means the study of.
2. There are other words like biology. The study of the earth is _____ while the study of ancient artifacts is _____.
3. Hematology is the study of _____ and the study of tumors or cancers is known as _____.
4. Being able to _____ or change location or position is evidence of life in a living thing.
5. A feature common to all living things is that they can make new living things. This process is known as _____.
6. Living things all require a source of _____ in order to carry out life processes. For humans this source is the _____ we eat, however for most plants, it is the _____ which provides this source.
7. Small living things increase in size and complexity. Living things _____ and develop.
8. Living things react or _____ to things around them which is also known as their environment.
9. _____ is the condition where evidence of life no longer exists.
10. The name of the primary author of this textbook is _____.

Read each example below and tell whether which form of evidence of life is being demonstrated. Some examples may have more than one evidence of life present.

Example: A puppy chases a ball. Movement

11. Tommy is hungry and so he eats three hot dogs for lunch. _____
12. A tree sparrow flees from an approaching cat. _____
13. The goose is incubating ten eggs. _____
14. The earthworm wriggles down deeper into the bedding in the bait cup.

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15. The sunflower tilts its flower towards the east in the morning hours.

16. Mushrooms tend to be found most frequently near dead or dying trees.

17. The kitten learns to catch mice by imitating its mother. _____

18. As the summer months go by, the ears of corn on the corn plants appear to be getting larger in diameter. _____

19. Allowing food to sit out unrefrigerated and then eating it can result in food poisoning.

20. The peach tree developed pink blossoms as the temperatures increased.

Choose an animal in your home or one you are familiar with. Tell what it is and then give four pieces of evidence that tells you it is a living thing. For example, if you choose your dog, a piece of acceptable evidence is that it needs to be fed everyday.

21. _____

- 1.
- 2.
- 3.
- 4.

Choose a plant in your yard or one you are familiar with. Tell what it is and then give four pieces of evidence that tells you it is a living thing.

22. _____

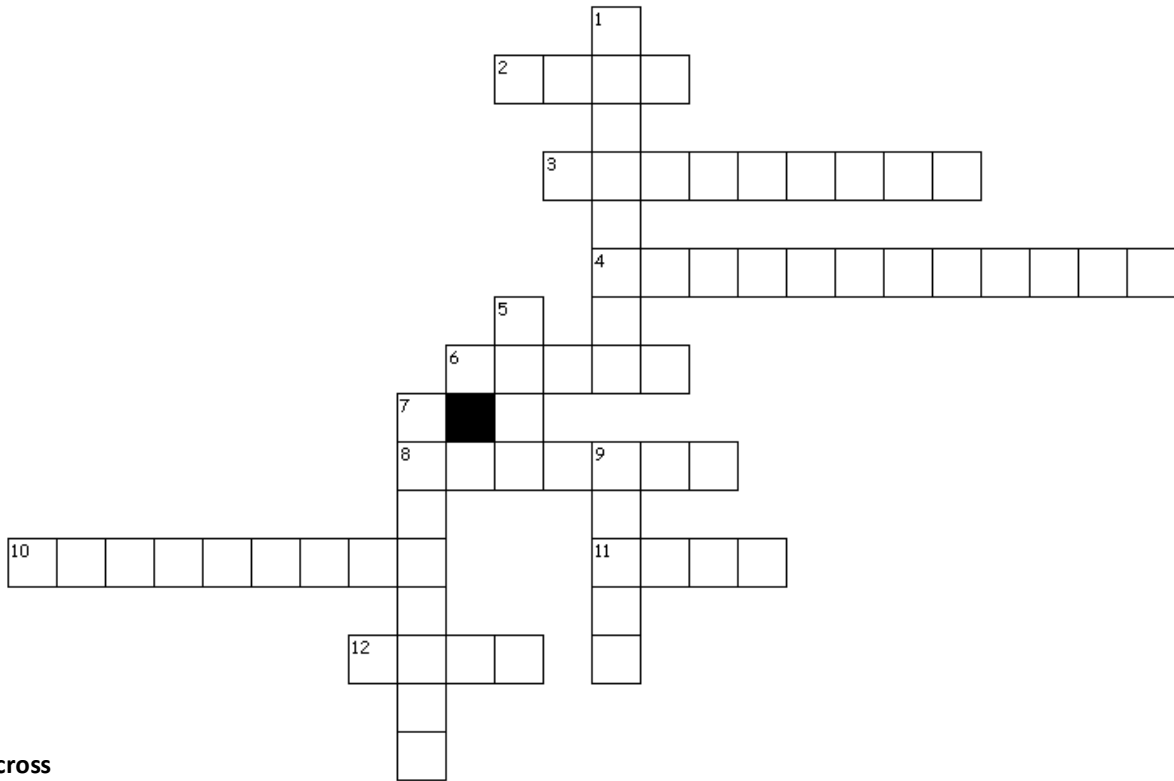
- 1.
- 2.
- 3.
- 4.

Name _____ Date _____

Lesson 1

Practice Page 2

Instructions: Below you will find clues to solve this crossword puzzle. Refer back to the text portion of the lesson for help.



Across

- 2. living things _____ and develop
- 3. process of a living thing making another living thing
- 4. requirement of living things in order to carry out life processes
- 6. when evidence of life no longer is present in an organism
- 8. living things _____ to their environment
- 10. author of this textbook
- 11. tumors or cancer
- 12. life

Down

- 1. changing position or location as indicator of being alive
- 5. earth
- 7. one complete living thing
- 9. the study of

