PASSING THE LOUISIANA END-OF-COURSE TEST IN BIOLOGY

Michelle Gunter

American Book Company
PO Box 2638
Woodstock, GA 30188-1383
Toll Free: 1 (888) 264-5877 Phone: (770) 928-2834
Fax: (770) 928-7483 Toll Free Fax: 1 (866) 827-3240
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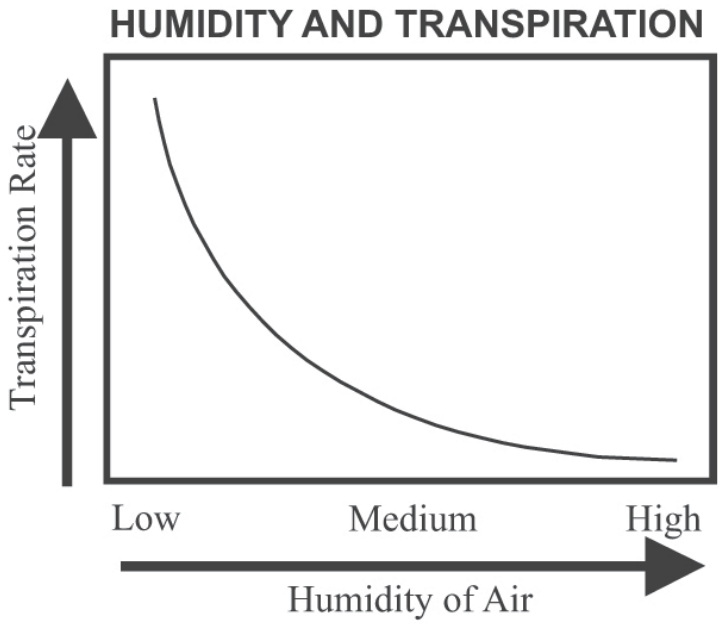
43. A graph showing the results of a scientific experiment are shown below.



Which conclusion is **best** supported by the evidence?

SI-H-A2, SI-H-A6
GLE 9

A. At 100% humidity, plants are losing the most moisture.

B. The rate of transpiration increases as humidity increases.

C. At 10% humidity, plants experience the greatest water loss.

D. The humidity of the air has no impact on plant transpiration rate.

Table 1.2 Insects Around Lights

Date	Time	Insects at Blue	Insects at Yellow	Temperature	Weather
4/10	4:10 am	22	14	65 °F	clear, full moon
4/11	4:09 am	44	16	69 °F	clear, new moon
4/12	4:11 am	49	17	68 °F	clear, new moon
4/13	4:11 am	39	6	70 °F	clear, new moon
4/14	4:14 am	35	9	65 °F	rain, quarter moon
4/15	4:05 am	39	11	70 °F	overcast, quarter moon
4/16	4:12 am	40	15	71 °F	overcast, quarter moon

Data recorded in a table can often be graphed to show the relationship between the data in a way that is easier to analyze. **Line graphs** are a great way to show how one variable — like the dependent variable — changes in response to the independent variable. The independent variable is plotted on the *x*-axis (horizontal axis), and the dependent variable is plotted on the *y*-axis (vertical axis). You can see this in Figure 1.10, where the amount of insects found is graphed vs. the phases of the moon.

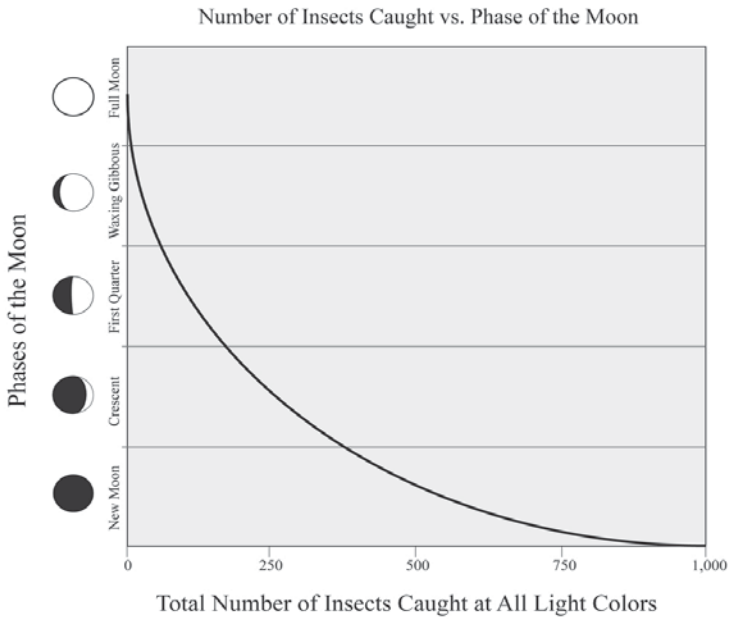


Figure 1.10 Line Graph of Insects Found at Ground Light vs. Phases of the Moon

Line graphs are also used to compare multiple groups of data. These are called **multiple line graphs**, and could be used to compare the data from two or more light colors.

A **circle graph**, also known as a **pie chart**, is used to show parts of a whole. Many times circle graphs show percentages of a total. Our amateur biologists might use a pie chart to show the percentages of various insects found at a single light source.

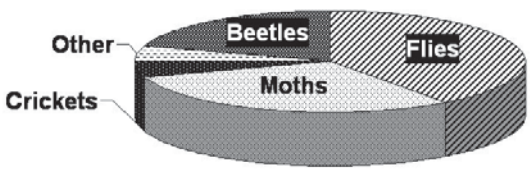


Figure 1.11 Circle Graph of Different Insects Found at a Light

LABORATORY SAFETY

Walking into science class on Monday morning, you see that materials are all set up for a lab. YES! You love lab days because you get to actually DO science. You observe the classroom on the way to your seat. Before doing anything else, you draw a picture of what you see going on in the classroom. The picture looks something like the one below.

Figure 3.2 A Classroom in Chaos

Well, scientific research is often connected with economic or political issues. These issues can influence the scientists performing the research by causing **bias** in their interpretation of the data. Biased data has been interpreted to suit the goals of the interpreter. Let's look at two situations that involve bias.

Figure 4.2 Ghost Activity?

Unintentional Bias

People usually pay more attention to data that confirms their beliefs. If you believe in ghosts, you are more likely to interpret mysterious sights or sounds as GHOST ACTIVITY! Someone who does not believe in ghosts would probably interpret a ghostly figure in the corner as the work of a pesky sister. *This kind of bias is unintentional.*

Intentional Bias

Figure 4.3 Acne Treatment?

People may give more weight to data that will give them a reward. If good clinical trial results for a new acne treatment will advance the careers of the researchers involved, they may be more likely to overlook the fact that the medicines make some of the study participants feel sick, sprout white nose hair or have bad skin reactions. *This kind of bias may be intentional.*

Whether intentional or unintentional, bias must be avoided when conducting a scientific investigation. This is usually accomplished by conducting **blind trials**, where the researchers do not know who has received the real medicine and who has received a **placebo** (this would be the control group).

Is bias the only reason that false information is published?

When a few different researchers all interpret the data differently, bias could be a factor. On the other hand, sometimes people just naturally look at things in different ways. It could also be that the experiment was poorly designed, giving unclear data. In this case, standards and controls of the experiment were not applied or maintained properly.

There is a final complicating factor that is exceptionally important to consider. There might be factors affecting the experiment that are not known, despite the best efforts to establish controls. This is especially true in environmental and biological research. For this reason, **data interpretation** is very important. In this step, you put all of your experimental data together and decide what each piece means. Incorrect and/or biased data interpretation will generate an incorrect conclusion. In these studies, data interpretation is very difficult and usually generates a lot of debate. There are a few questions you can ask while examining data. These questions can help uncover bias present in experimental results.

Strand 1: Science as Inquiry Review

1. Which biological question below can be answered through scientific investigations?

   A. Is cloning morally acceptable?

   B. Are male red cardinals more beautiful than brown female cardinals?

   C. How are the genes that cause obesity passed from mother to child?

   D. How do ghosts cause quick extreme temperature fluctuations?

2. Zoë became interested in factors that cause cloud formation. Which statement below is a testable hypothesis?

   A. Clouds are prettier when they are fluffy and white.

   B. Do temperature and humidity affect cloud formation?

   C. A lake at 32 °C will create more clouds than a lake at 22 °C.

   D. Clouds are high up in the atmosphere.

3. You want to find out what type of bacteria live on your kitchen counter. Which piece of equipment would you use to culture the bacterial colonies?

   A. graduated cylinder

   B. test tube

   C. microscope

   D. Petri dish

4. Marana was interested in organization, and she was attempting to better organize her daily routines. Over a full 24 hour period, she recorded the different types of activities she did and how long she spent doing each activity. Which graph would be **most useful** to help Marana better organize her day?

   A. pie chart

   B. line graph

   C. bar graph

   D. diagram

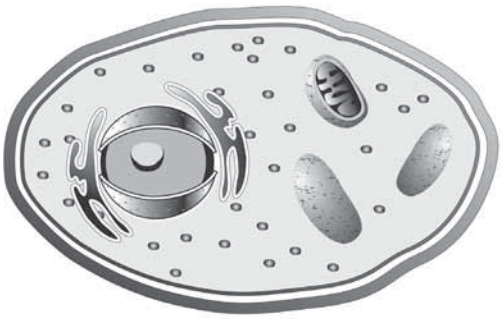


Figure 5.5 Eukaryotic Cell

A **eukaryotic** (*eu*- true; *karyotic*- nucleus) cell has a nucleus surrounded by a nuclear membrane. It also has several membrane-bound organelles. Eukaryotic cells tend to be larger than prokaryotic cells. Plant and animal cells are both eukaryotic and, although similar in structure, contain unique cell parts. For instance, plant cells have a cell wall and chloroplasts, while animal cells have centrioles and some even have cilia and flagella. See Figures 5.5 and 5.6 for schematic drawings of eukaryotic cells, including plant and animal cells. Table 5.2 lists definitions of the parts in eukaryotic cells.

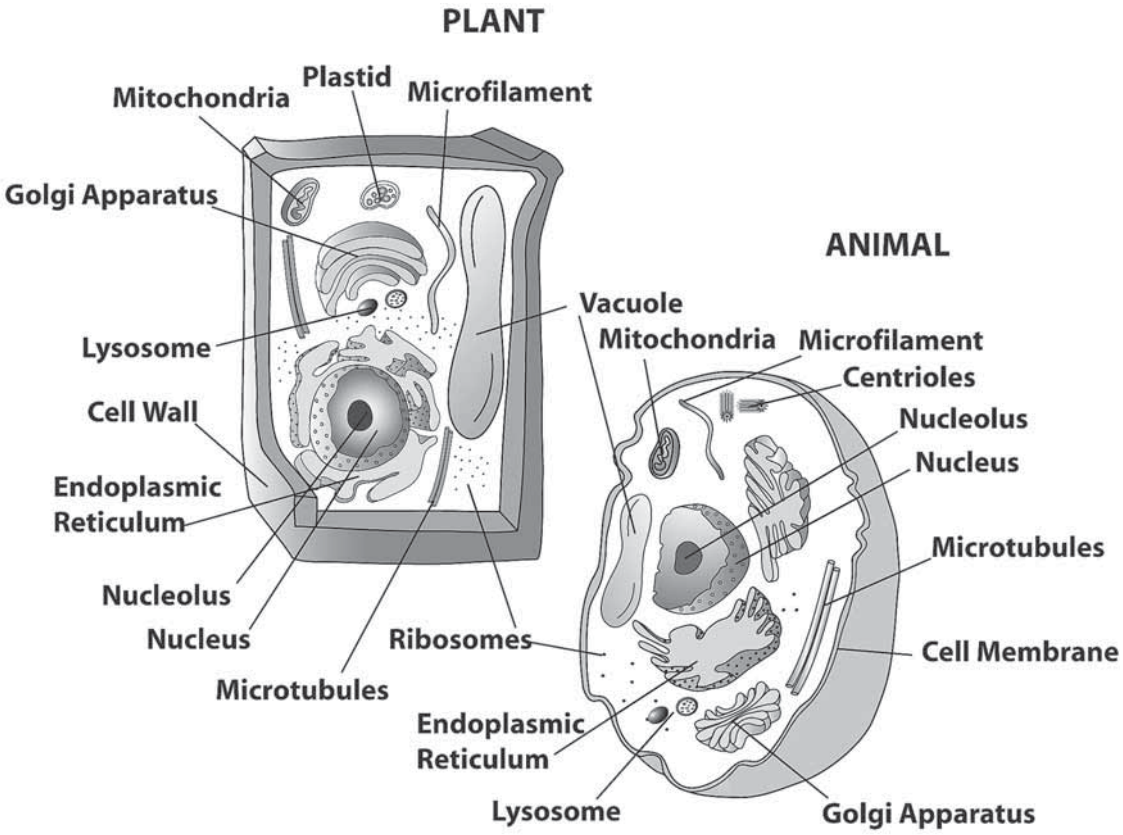


Figure 5.6 Parts of the Cell – Specific

Activity

Before cells and cell theory, people believe that plants and animals came from non-living things. They even wrote "recipes" for creating animals. **Spontaneous generation** is the idea that living organisms can come from non-living things. Research how scientists worked to disprove this idea. Also include an ancient recipe for making an animal from non-living things.

DNA is located in the nucleus of the cell. The assembly of proteins occurs outside of the nucleus, on the ribosome. So the manufacture of proteins involves three basic steps:

1. **The DNA code of the gene segment must be copied in the nucleus of the cell.**
2. **The code must then be carried from the nucleus into the cytoplasm and finally to a ribosome.**
3. **The protein is then assembled from the code and released from the ribosome.**

These steps are carried out by RNA, or ribonucleic acid.

RNA

RNA (**ribonucleic acid**) is a molecule used to translate the code from the DNA molecule into protein. It is similar to DNA, except it is single stranded. Its sugar is **ribose**. RNA, like DNA, has four nitrogenous bases. It shares adenine, guanine and cytosine but replaces thymine with **uracil** (U), so the bases A and U pair up instead of A and T. There are several types of RNA. Messenger, ribosomal and transfer RNA are all involved in protein synthesis.

Protein Synthesis

There are many proteins within every cell. Proteins make up **enzymes** that help to carry out reactions within the cell. Proteins also compose **hormones**, which are chemical messengers that regulate some body functions. Proteins provide structure and act as energy sources. They transport other molecules and are part of our bodies' defenses against disease. In short, proteins are essential for survival because almost everything that happens in the cell involves proteins. Remember, protein synthesis is the process of making proteins from the DNA code. To see this process, go to http://www.americanbookcompany.com/science.

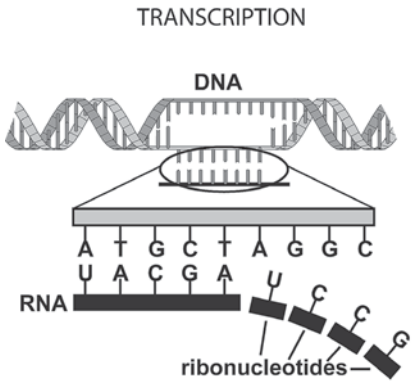


Figure 6.2 Transcription

Transcription

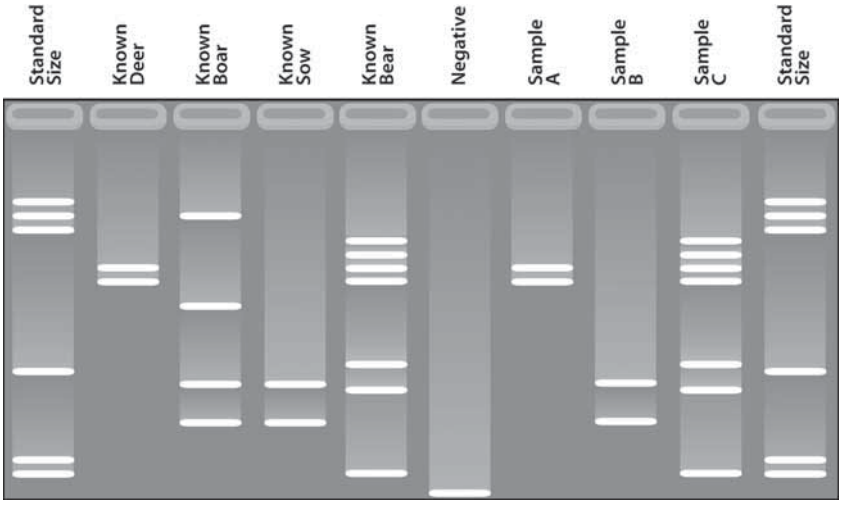
The first step of protein synthesis is the manufacture of a specific kind of RNA called **messenger RNA** (**mRNA**). This copying process is called **transcription**. Transcription begins when a region of the DNA double helix unwinds and separates, as shown in Figure 6.2. The separated segment is a gene, and it serves as a template for the soon-to-be-formed mRNA strand.

The mRNA strand is assembled from individual RNA nucleotides that are present in the nucleus. An enzyme called **RNA polymerase** picks up these unattached nucleotide bases and matches them to their complementary bases on the DNA template strand. This continues until the entire gene segment has been paired, and a complete mRNA strand has been formed. This mRNA strand has a sequence that is complementary to the original gene segment. At that point, the mRNA separates and leaves the nucleus, moving out into the cytoplasm to settle on the **ribosome**, an organelle composed of another kind of RNA, called **ribosomal RNA** (**rRNA**). Here on the surface of the ribosome, the process of translation begins.

Activity

Recently, black bear populations in Dundelbur, Alabama have been declining. As a result, the Department of Natural Resources (DNR) closely monitors hunters in the area. Persons caught harvesting bear in this area face stiff fines and possible jail time. Clarence Obvious was reported to your DNR office as a possible bear poacher. As the local DNR representative, you must find him and discover if he is innocent or guilty. You get a warrant to search his freezer and discover three questionable meat samples. Clarence claims that these samples are from a deer, a boar (male hog) and a sow (female hog) he shot earlier this year. You send these samples to your DNA lab. At the lab, known samples of bear, sow, boar and deer are compared with Clarence's meat.

Examine the results for yourself.



Was there bear meat in his freezer?

Is Clarence innocent or guilty? How do you know?

THE FOSSIL RECORD: MORE EVIDENCE OF EVOLUTION

Fossils provide perhaps the most compelling evidence for the change in organisms over time. A **fossil** is the recognizable remains or body impressions of an organism that lived in the past. The study of fossils gives us a fascinating historical perspective — snapshots from an Earth of long ago. Taken together, these snapshots are referred to as the **fossil record**. Scientists use the body of evidence accumulated from the fossil record to make hypotheses about organism evolution. They often see sequential changes in a group of organisms over time. Sometimes they observe maintenance of certain characteristics or organisms over a long period of time.

In one well documented case, the evolution of the modern horse is shown through fossils collected from the Eocene epoch (55 million years ago) through modern rock strata. The fossils collected show the clear changes in body structure of the modern horse. The oldest ancestor, hyracotherium, was a forest dwelling organism about the size of a fox. It had an omnivorous diet eating foliage, fruits, flowers and insects. It had many toes on its soft padded feet and short legs. These were adaptations for walking on the soft forest floor. It also had low crowned teeth filling the entire mouth capable of chewing a variety of foods.

Over time, the lush forest environment changed to become drier and supported fewer trees and more grasses. In order to survive in the changing prairie-like grassland, hyracotherium needed different traits. From Figure 7.23, we can clearly see that over the next few million years the height and size of the horse increased. Notice the sequential nature of the fossils in this group. Its legs lengthened and reduced the number of toes on its feet. Additionally, its teeth became tougher and more capable of grinding grasses.

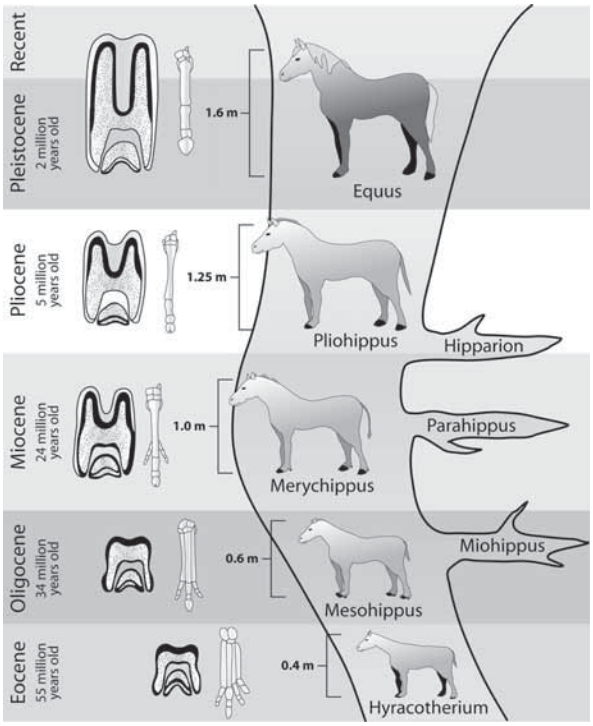


Figure 7.23 Evolution of Horse

Eventually the modern horse, equus, developed long legs and tough hooves. These adaptations allowed it to outrun predators. In addition, the larger height allowed equus to see over tall grasses spotting potential predators before they got too close. Another anatomical change was in the teeth. We can see the modern horse has high crowned teeth adapted for a lifetime of grinding grassy stalks.

endocrine system disorders, infertility, personality disorders, skin conditions, memory disorders and birth defects. Pesticides and other chemicals used in modern agriculture have decreased species diversity.

Oil Spills

Oil is one natural resource humans use every day. This resource is drilled from deep within the Earth. Perhaps you are familiar with oil wells or oil platforms. The state of Louisiana has many offshore oil drilling platforms. These platforms drill oil from under the Gulf of Mexico. Tanker ships bring the oil to the mainland.

Figure 8.17 Oil Platform

Figure 8.18 Oil Soaked Duck

Sometimes these boats leak or have an accident. When this happens it is an oil spill. **Oil spills** are the release of petroleum, or oil, into the environment from human activity. Oil spills kill wildlife, and poison the environment. Birds and other mammals covered in oil eat the oil and get sick. They also loose their waterproof ability. Often they can no longer stay insulated against the environment. In 2010 there was a large oil spill in the Gulf of Mexico. This spill was caused by an accident aboard an oil platform. The full environmental scope of this accident is yet unknown. However, some argue this oil spill is the worst natural disaster to ever occur on American soil. One positive outcome of this disaster is improved clean-up techniques.

People must clean oil spills to prevent permanent harm. There are several methods used to clean up oil spills. Sometimes detergents, or soap, clean the oil off shorelines and animals. Other times, special bacteria sprayed on the spill eat the harmful oil. Some other methods are skimming, vacuuming or burning the oil off the surface of the water. Humans require a continuous supply of energy. Oil spills and other environmental accidents will happen as a result of our energy exploitations. We must learn responsible and environmentally friendly ways to extract and use energy resources.

Habitat Reduction

Figure 8.19 Logging Operation

Humans disrupt and use natural lands. This causes habitat reduction. Used by people, the habitat can no longer support other organisms. Clearing forests for neighborhoods, agriculture or logging disrupts a forest. Plowing grassland for agriculture disrupts the prairie. Draining a swamp to build a neighborhood destroys the wetland. Agriculture, logging, mining and cities all destroy natural lands. Even suburbs displace native plants and animals.

ORGANIZATION OF ECOSYSTEMS

ECOSYSTEM

An **ecosystem** is the interdependence of plant and animal communities and the physical environment in which they live. It is a system, exchanging energy and matter in an every repeating cycle. The **biosphere** is the zone around the Earth that contains self-sustaining systems composed of biotic and abiotic factors. **Biotic** factors include all living things, such as birds, insects, trees and flowers. **Abiotic** factors are those components of the ecosystem that are not living, but are integral in determining the number and types of organisms that are present. Examples of abiotic factors include soil, water, temperature and amount of light. In order for an ecosystem to succeed, its biotic factors must obtain and store energy. Plants and animals interact with their environment. Because of this delicate interaction, changes to the environment often impact species survival.

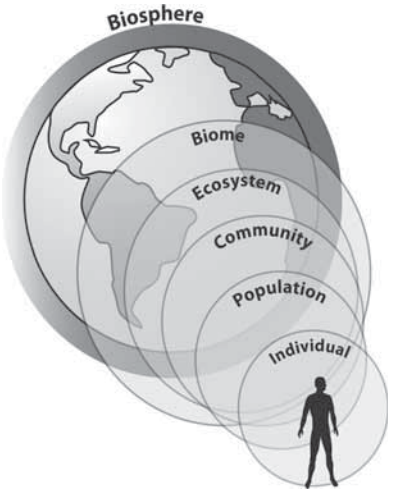


Figure 9.7 Organization of Life

COMMUNITY

A **community** is a collection of the different biotic factors in a particular ecosystem. Communities include many different species of plants and animals that live in close proximity to one another. For example, in a marine ecosystem a coral reef supports a large community of plants and animals. In this example the community of fishes, shrimps, mammals, algae, sharks, corals, urchins, sea stars and clams all live together and interact with one another. A community might have very different types of plants and animals living in one area. The members of a community interrelate with each other. Deer grazing in a clearing in the forest may be alert to the activity or movement of birds that warn them of approaching danger. In turn, the birds may depend on the deer grazing in a clearing to disturb insects hiding in the grass, thus causing them to become visible.

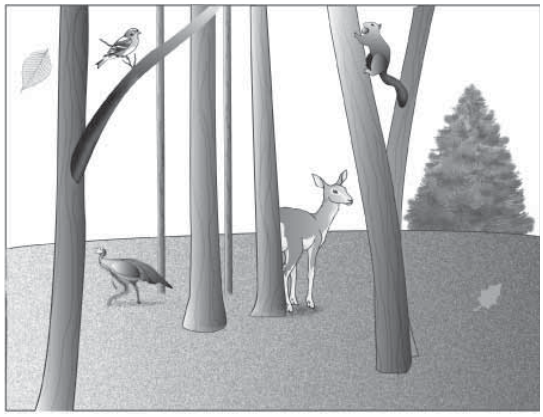


Figure 9.8 A Forest Community

Each member of a community has its own **habitat**. A habitat is the dwelling place where an organism seeks food and shelter. A woodpecker lives in a hole in a tree. It eats the insects that live in the bark of the tree. A robin builds its nest and raises its young in the same tree. A mouse lives in a burrow at the base of the tree. An owl sleeps on a branch of the same tree. The tree supports a whole community of organisms and becomes their habitat. The habitat provides food and shelter for the members of the community. In turn, each species of the tree community has its own **niche**. A niche is the role that an organism plays in its community, such as what it eats and where it lives.

Muscular System

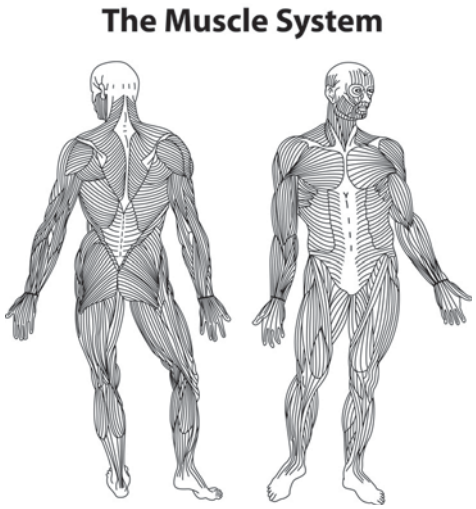


Figure 10.8 Muscular System

The **muscular system** works together with the skeletal system and the nervous system to enable appropriate movement. It also facilitates the function of internal organs. Energy in the form of ATP is used to make a muscle contract. The nervous system directs this muscular movement. For instance, if you touch something hot, a nerve impulse makes you jerk back, and muscle allows that movement to take place. This nerve to muscle reflex is a protective mechanism. Most muscle tissue is **skeletal**; it is attached to the bones of our skeletons and moves our bodies. These muscles are **voluntary**, meaning we can decide when and how to make them move. A second type of muscle is smooth muscle. **Smooth muscle** is found in the internal organs and makes up the walls of blood vessels. It is involuntary muscle, meaning we do not have conscious control over its movements. Without smooth muscle, food would be unable to pass through the digestive tract. The third type of muscle is **cardiac muscle** and is found in the heart. It is specialized to be able to withstand many contractions without becoming fatigued. Cardiac muscle is also **involuntary**.

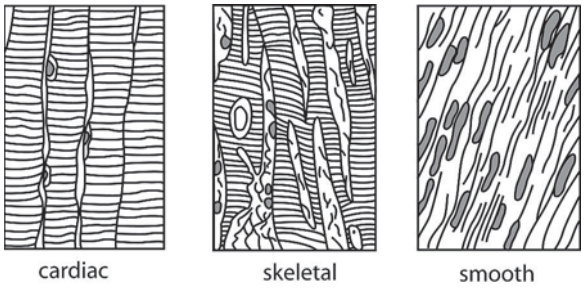


Figure 10.9 Muscle Types

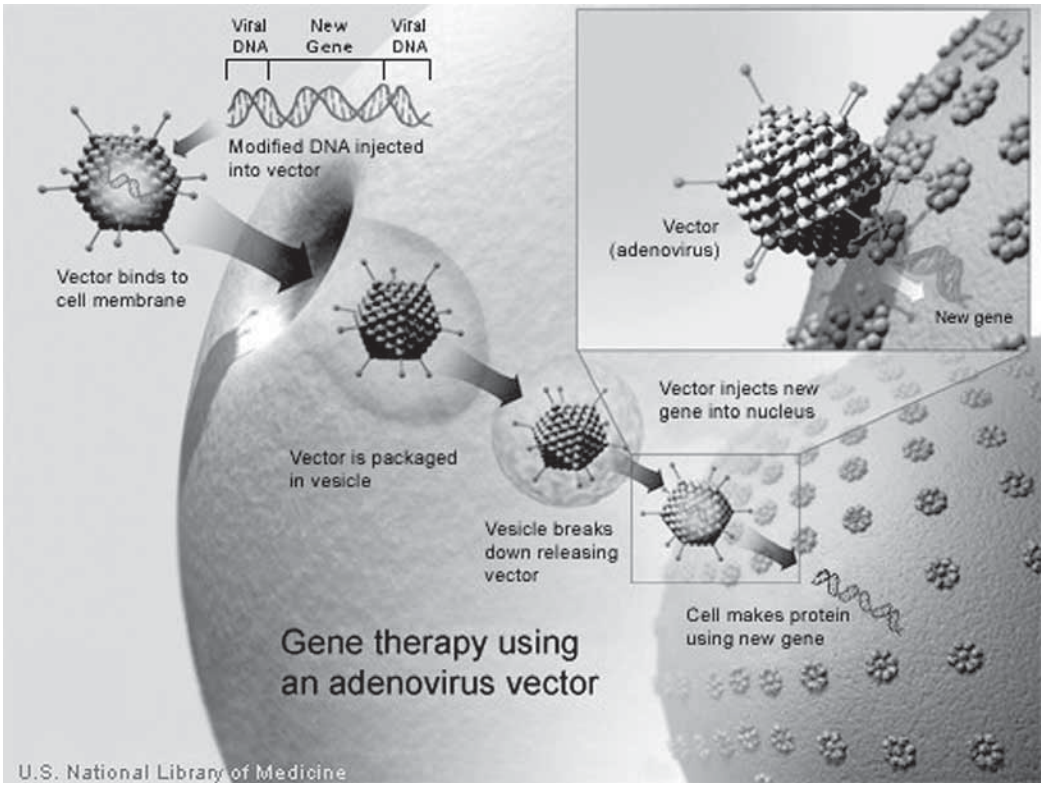


Figure 11.18 Gene Therapy Using a Virus as a Vector

Tissue culturing allows bioengineers to grow human tissues and organs in the laboratory. Human ears, livers and heart cells have all been grown in the laboratory. It is hoped that these tissues can be used to help patients that are injured or need an organ transplant.

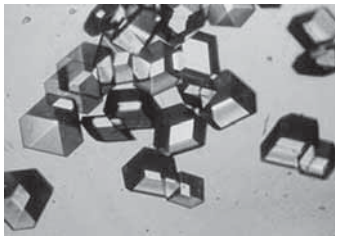


Figure 11.19 Human Insulin Crystals

Biotechnology is often used in **drug development**. One such example is bioengineered bacteria that have been used to treat patients suffering from diabetes. The gene that produces human insulin has been inserted into bacterial cells. The bacteria, which reproduce quickly, can make vast quantities of insulin far cheaper than traditional animal sources of the hormone. Figure 11.19 shows human insulin crystals produced in this way. This type of medical therapy has been used to help people suffering from blood disorders, hormone imbalances, arthritis and growth deficiencies. It has also been used to produce cheap antibiotics.

Activity

Edward Jenner was instrumental in the development of modern vaccination programs. Other important historical figures include Jonas Salk, Albert Sabin, Walter Reed and Louis Pasteur. Select one individual. Research their life and write a short creative action adventure story about their life and role in development of germ theory. Include at least 10 facts in your story. For example, for Jenner, you can pretend he is a superhero trying to rid the world of the evil Dr. Smallpox. Illustrate your story with drawings.

- type and amount of cloudiness
- type and amount of precipitation
- air pressure
- speed and direction of wind.

Variations in these factors produce different climates, and thus different biomes on the Earth. For instance, a rainforest biome has a markedly different climate than a desert biome. For this reason, we see many different types of plants and animals on Earth. Variations in weather and climate generate differences in plants and animals as these organisms adapt to their environments. Many animals have developed adaptations to insulate themselves from temperature extremes. **Insulation** is material used to slow the exchange of heat.

Natural Insulation

When people talk about insulation they often think of the man-made pink fiberglass material used in homes. This material shields our homes from temperature extremes. Figure 12.7 shows how insulation can slow the exchange of heat in a closed system — like a home.

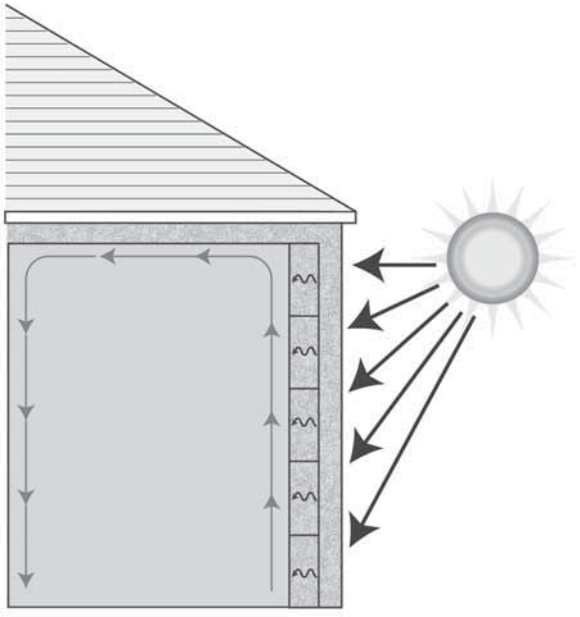


Figure 12.7 Insulation Slows Heat Transfer

We can also trace the effect of insulation on energy transfer in a closed system with a simple experiment.

Try this!

Materials: three identical small plastic cups, a larger metal, Styrofoam and paper cup, three shoe boxes and three thermometers.

1. Place boiling water inside each of the smaller plastic cups.

CHAPTER 13 REVIEW

1. What is the only type of rock produced by cooling?

   A. igneous B. sedimentary C. metamorphic D. magma

2. Which of the following transitions does **not** happen in the rock cycle?

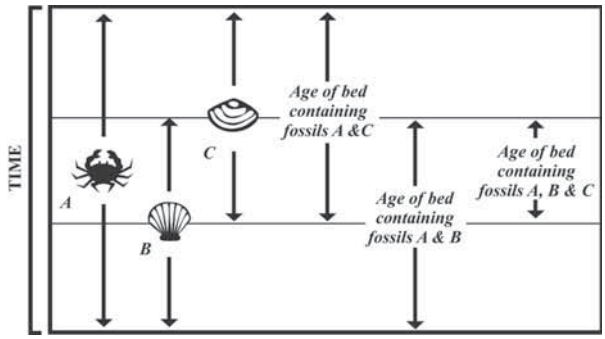
   A. Weathering and erosion convert igneous rock to sediment.

   B. Heat and pressure convert igneous rock to metamorphic rock.

   C. Weathering and erosion convert metamorphic rock to sediment.

   D. Heat and pressure convert metamorphic rock to igneous rock.

Use the diagram to answer questions 3 – 4.



3. Which statement accurately describes the longevity of the organisms shown in the fossil layers?

   A. Organism A existed over a longer period than Organisms B or C.

   B. Older fossil information is necessary to determine whether A or B existed longer.

   C. Newer fossil information is necessary to determine whether A or C existed longer.

   D. Statements B and C are both correct.

4. An archeological expedition uncovers new fossils of Organisms A and B in the same area. Rudimentary dating using the ^{14}C radionuclide indicates that these two fossils are the oldest of their kinds yet found. A respected archeological journal reports "Organism A fossils contain a higher percentage of nitrogen-14 than Organism B fossils!" What conclusion can you draw from this information?

   A. Organism A existed before Organism B.

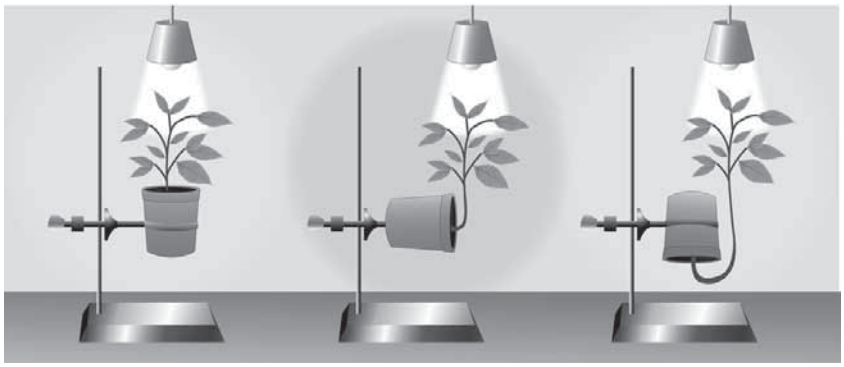
   B. Organism B existed before Organism A.

   C. The margin of error for radiometric dating is too large to make a determination.

   D. Radiometric dating should be repeated with a longer-lived isotope to make a better determination.

13. Fabio did an experiment involving the growth of plants. Seedlings were planted in pots and then set up as shown in the diagram below. The diagram shows the growth of the plants as of week 16 of the experiment. All of the plants were planted in the same type of soil, given the same amount of light and water, and were kept at a constant temperature. Based on the diagram below, which one of the following statements is a valid conclusion that Fabio can draw from his experiment?

SI-H-A6, A2
GLE 9



A. The plants used in the experiment tend to grow toward their light source.

B. The plants used in the experiment will always tend to grow away from their light source.

C. All plants need a light source.

D. The size of the plant is a function of the amount of light it receives.

14. A scientist is examining the amount of time it takes cells to complete the cell cycle. At the end of the experiment, he checks over his data. The data is not what he expected. Which of the following actions would help him verify his data?

SI-H-A2, A4
GLE 4, 7

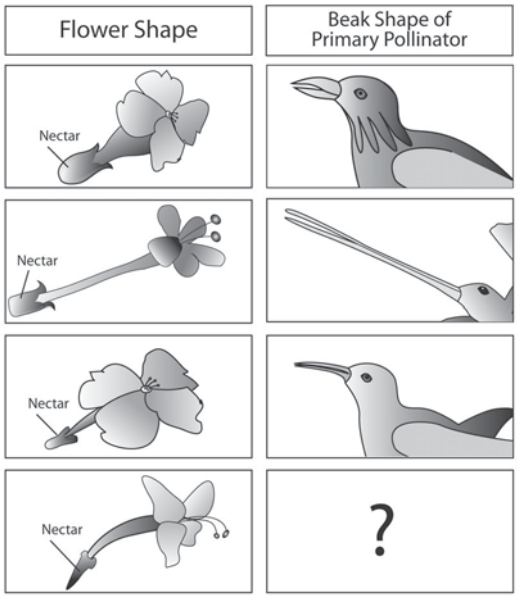
A. Repeat the experiment.

B. Publish the results.

C. Clean up the lab.

D. Make a new hypothesis.

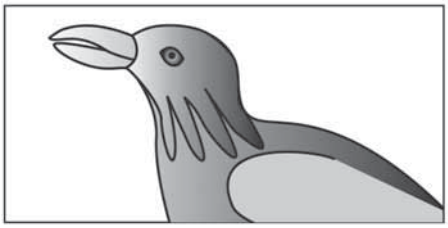
On a certain island, most flowers have small, narrow pollen tubes leading to their nectar supply. Hummingbirds are the main pollinator on this island. All the hummingbirds on this island arose from a single immigrant to the island. The diagram shows the relationship between hummingbirds and flowers.



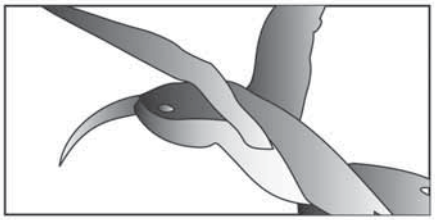
14. Which beak shape would **best** pollinate the last flower in the diagram?

LS-H-C3
GLE 17

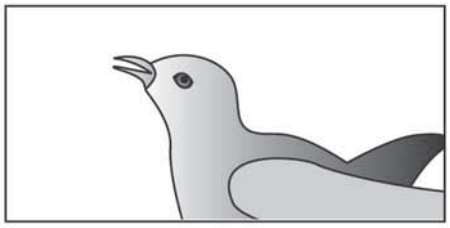
A.



C.



B.



D.