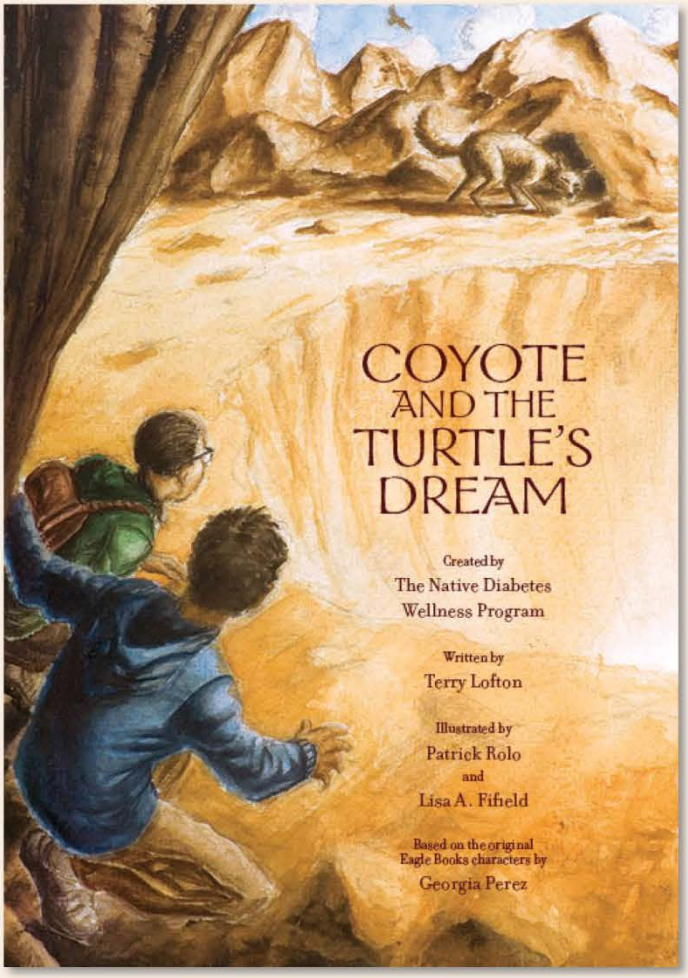
Eagle Books

Youth Novels: Educators and Community Guide

For Coyote and the Turtle's Dream



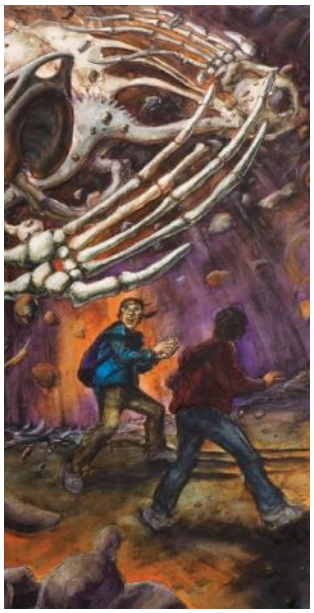
Science

PART 1: INVESTIGATING EARTH'S HISTORY
LEARNING FROM THE PAST

OBJECTIVES

- Identify the main components of the earth's composition and explain that movements of the earth's crust (mantel) can deform its surface over time.
- Understand that movement of the earth's crust can cause the locations of oceans and continents to shift.
- Explain how sedimentary rocks are formed and how fossils are created within them.
- Relate the movement of the earth (plate tectonics) to evidence of aquatic fossils in regions that are no longer under water.
- Identify local geological evidence of change over time.
- Relate oral traditions of American Indians and Alaska Natives to geological history.
- Investigate the role of wind and water erosion in uncovering the history of the earth. Relate these forces to the fossils found in the cave in the book, *Coyotes and Turtle's Dream*.
- Explain why understanding the earth's past plays an important role in protecting its future.

Background for Teachers



The earth is a dynamic environment that is constantly changing. A delicate balance exists between air, water, and the earth and its living organisms. Earth and its systems change over time, both naturally and as a result of human activity. Native American traditions recognize this dynamic environment and the role that humans play in maintaining its balance. That role involves respecting living things and being thankful for the gifts that the earth provides. There are many lessons to be learned if we pay attention and listen to what the earth tries to teach us. Over the thousands of years that the people have lived in the Western Hemisphere, they have observed remarkable events and passed them down as stories of the land. Geologists are now acknowledging the value of Native American oral traditions as evidence that helps to explain our geologic past. This is an example of how different kinds of "knowing"—both Native and Western—produce new and valuable knowledge.

In *Coyote and the Turtle's Dream*, the geologic past is a very important part of the story's setting. Amazing fossils of dinosaurs, other reptiles, and small mammals were discovered in a cave very far from the ocean. How is it that we find fossils of aquatic organisms in high plateaus, mountains, and throughout the Midwest?

The surface of the earth is constantly changing. Fossil and geological records are one way we can study the past. We can look at the layers and types of soil and rock as well as what is trapped within them to determine what happened in the earth's history and by extension, human history. In order to draw proper conclusions from this evidence, we must also understand the structure of the earth's crust, the forces acting on it, and how it changes. The earth's mantle is made largely of rock plates that float over a central molten iron core. The upper surface above the mantel consists of crustal plates that shift and bump into each other causing them to deform. The study of movement of these crustal plates is called tectonics. *Divergence* occurs when plates move away from each other. *Convergence* occurs when plates move toward each other. Convergence can cause plates to collide creating volcanic activity and earthquakes. The denser plate (its composition is heavier and more compact) moves underneath the less dense plate in a process called *subduction*. Less dense plates ride on top of the denser plates and undergo uplifting. This is the reason fossils once at the bottom of an ocean can be found high in the mountains. The plate movements and resulting deformations constantly rearrange the earth's landforms and oceans. As a result we can find evidence of ocean fossils on dry land where oceans no longer exist.

It is important to learn from the past in order to make good choices for our future. In addition to the natural cycles that occur in nature over time, we also need to look at and evaluate human impacts on our environment. Human activities can result in significant changes to the environment—some of which can have very damaging effects. In *Coyote and the Turtle's Dream*, the healthy balance between the land and the people was disrupted when the Great Turtle's rest was interrupted by the theft of her bones. She no longer dreamed of the waters in which she once swam. This symbolic interference with Shell Ridge, and the ancient water-bearing rock beneath it, caused the Gift of Life (water) to disappear. Understanding environments of the past can help us better predict and manage the effects that human interventions can have on the resources necessary for life. Carefully studying the past and the present will hopefully allow us to make better decisions about balancing human needs and those of the environment in order to provide for a healthy future.

The three Indian boys stood in silence looking out at the geological majesty before them.

Online Resources

The Geology of North America as Illustrated by Native American Stories.
http://www.units.muohio.edu/cryolab/publications/documents/McWilliams%20Geology%20NA%20Illus%20NA%20Stories.pdf

Oregon Department of Geology and Mineral Industries. Geologic Hazards on the Oregon Coast:Prehistoric and historic tsunamis. Using Native American oral traditions as evidence of past geological events.
http://www.oregongeology.com/sub/earthquakes/coastal/HistoricTsunamis.htm

The Virtual Fossil Museum. Geological History Over Geological Time.
http://fossilmuseum.net/GeologicalHistory.htm

United States Geological Survey: Our Changing Continent. http://pubs.usgs.gov/gip/continents/

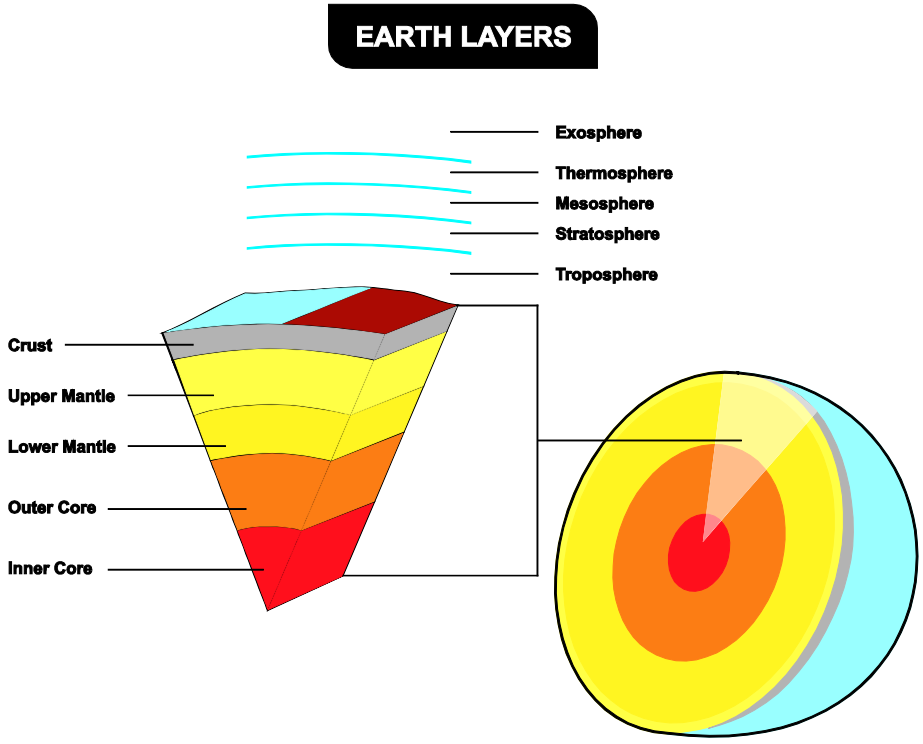
Earth's Geological Timeline—National Earth Science Teachers Association.
http://www.windows2universe.org/earth/past/geologic_time.html

INVESTIGATION 1
INVESTIGATING PLATE TECTONICS

Background for Teachers

Look at models of the earth's structure. The earth has three layers: the earth's crust, mantle, and core. The earth's crust, a relatively thin layer of rock, slides over the mantle, a hot semi-solid rock layer. The core at the center of the earth has an outer layer of liquid metal and an inner core of solid metal. The earth's crust is divided into plates that move around, bump together, and then slide under and over each other. In this activity, we will simulate tectonic movements.

To get the activity started, you may have students color and label a cross sectional diagram of the earth's crust, mantle, and core. Teachers can print off diagrams from many sites available on the Internet.



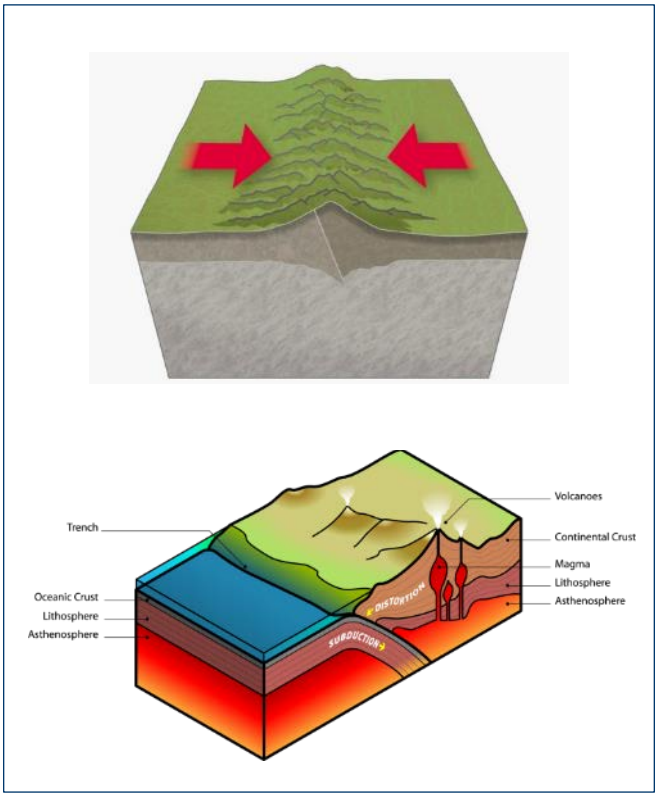
ACTIVITY
Crusty Flakes

Duration: 30-40 minutes

Materials

For each group:

- Flexible bowl (the bottom of a 1- or 2-liter plastic soda bottle or margarine container, washed and dried)
- Mantle material (low fat yogurt or other edible viscous material)
- Crustal plate material (large whole wheat cereal flakes or fruit leather cut up into 1 inch squares)
- Spoons



The top model shows the process of mountain building through the convergence of two crustal plates; the bottom model shows the processes of convergence, subduction, and uplifting.

Online Resources

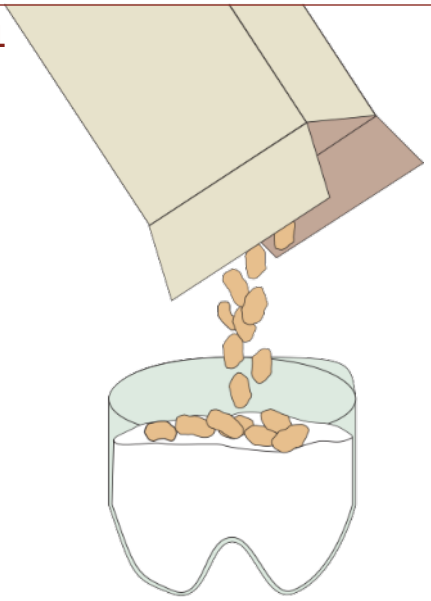
Snack Tectonics. Model tectonics using foods. http://www.windows2universe.org (Search on Snack Tectonics.)

United States Geological Survey. Active volcanoes and plate tectonics. http://vulcan.wr.usgs.gov/Glossary/PlateTectonics/Maps/map_plate_tectonics_world.html

Procedure

1. Fill the bowl with 1 to 2 inches of mantle material (yogurt). Allow for the rim of the bowl to extend at least 2 inches above the yogurt.
2. Carefully arrange crustal plate material to barely cover the mantle material in a single layer.
3. Simulate various energy movements through the mantle. Motions need to be strong enough to cause the cereal flakes or fruit leather to move abruptly but not spill over the sides. Possible activities include:
   - Spinning the dish without spilling the contents and stopping suddenly
   - Moving the bowl in various directions or moving back and forth
4. Record the effect on the crustal plates by drawing pictures of their rearrangement and identifying the energy movement used. Students may try more than one movement but they must record each as a separate record.
5. Have students identify any evidence they have in the bowl of the common types of tectonic movements. Circle any occurrences on their drawing. Be sure to clearly label the type of tectonic movement represented. Was there any convergence, divergence, subduction, or evidence of flakes moving on top of others? If students did not contaminate their "crusty flakes" and mantle, they may eat the contents of the bowl!

1



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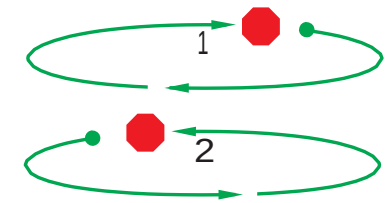
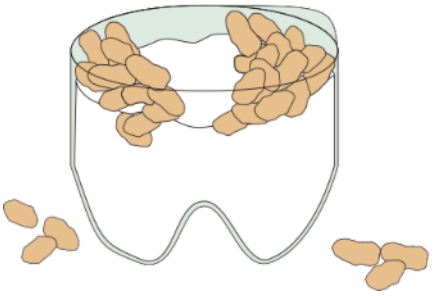




Follow-Up Activities

- Share results with other groups.
- Discuss how the movement of the flakes demonstrates the behavior of the earth's tectonic plates.
- Ask students to find out if their Tribe tells stories about how certain land formations were made.

Instructor Notes

- Students will need to move the bowl forcefully to shift the flakes around. Abrupt movements are better than smooth or continuous movements. Point out that the overlapping and lifting up of the edge of one flake over another is supposed to represent the movement of crustal plates when they bump into each other.
- If the yogurt or pudding is too thick, add a small amount of milk to make it a little thinner.
- Suggest that students add fossils (dried fruit) to make eating the result more interesting.

INVESTIGATION 2
INVESTIGATING SEDIMENTARY ROCK AND FOSSIL FORMATION

Background for Teachers

There are three main types of rock formation: sedimentary, metamorphic, and igneous. Fossils are formed in sedimentary rock layers. Sedimentary rocks are formed by sedimentation in aquatic environments and by deposition on land. Sedimentary rock is formed by the buildup of dead plant and animal material that falls onto the sandy bottom of an ocean or lake. The sand comes from the erosion and weathering of rocks and minerals over very long periods of time. Because of the way they are formed, sedimentary rocks contain excellent records of geologic time and events.

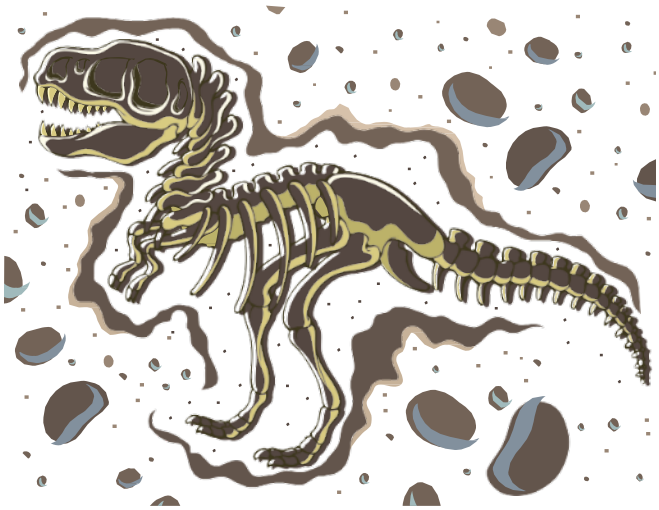
Fossils are created during the process of sedimentary rock formation. When organisms die and fall to the ocean floor they are quickly buried which reduces their exposure to oxygen and microorganisms that cause tissues to decay. With the decay processes slowed down, the dead organisms remain relatively intact. As the pressure of the sedimentary rock layers increases over time, the tissues of the remaining organisms are replaced by minerals. This is the process of *fossilization*. The fossils become hard and encased in the sedimentary rock.

"The flats" at Shell Ridge was sedimentary rock that had once been the bottom of the Western Interior Seaway, a shallow sea that formed during the Cretaceous Period from 65-125 million years ago. It stretched from the Gulf of Mexico in the south to the Arctic Ocean in the north, and from Rockies in the west to the Appalachian Mountains in the east. Rain, Boomer, and Simon collected the fossilized remains of creatures that once lived in that sea when they went hunting for shark teeth at Shell Ridge. The Western Interior Seaway, a prehistoric ocean that no longer exists, was home to the Great Turtle, *Archelon ischyros*, 65-75 million years ago, just before the extinction of the dinosaurs.

Investigate the different ways that sedimentary rocks are formed, using the Web sites provided, other online resources, or referring to books in the school library. Discuss why it takes such a long time for the sediments to turn into rock. Identify what other factors, in addition to time, play a role in this process. Identify the different types of sedimentary rock and what caused the differences in their formation.

ACTIVITY
Rocks and Bones

Duration: 45 minutes for setup; two weeks for completion



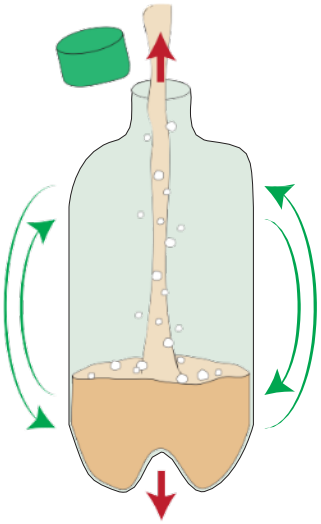
Materials

- 500-milliliter plastic drink bottles with caps on and labels removed. (One per person or group)
- Sediment materials: sand, dirt, clay, pebbles, aquarium gravel, or very small rocks and dry leaves
- Fossil material: small shells or shell fragments, twigs, small dried bones, or bone pieces
- Water
- Salt
- Scissors
- Knife or other sharp pointed object
- Spoons
- Toothpicks or small metal picks
- Permanent markers
- Ruler
- Newspaper or paper bags

Procedure

1. Obtain a 500-milliliter water bottle and label with your name or initials near the bottom on the side.
2. Add small amounts (about 1 inch) of sand, dirt, clay and aquarium gravel to the bottle. Make sure you fill the bottle more than half way. Add a teaspoon of salt. Place the cap on tightly and shake well. Record observations of what is happening in the bottle.
3. Remove the cap and add a small amount of dried leaves, one bone fragment, one shell, and a small pebble or two.
4. Slowly add water to the bottle until it is within 1 inch of the top (about where the sides of the bottle start to curve in toward the neck). Set the bottle on a flat surface and record observations about how the water is absorbed into the sediments.
5. Replace the cap tightly. Shake the bottle vigorously to simulate rapid movement of water in a river or during a storm. Set the bottle back on the flat surface and record what happens as the sediments settle. List what settles first, second, etc. Students should also keep track of how long it takes to settle. Repeat this step several times the first day. Record any differences seen in the sedimentation process with each "storm." Let the bottle sit overnight undisturbed.

1–2



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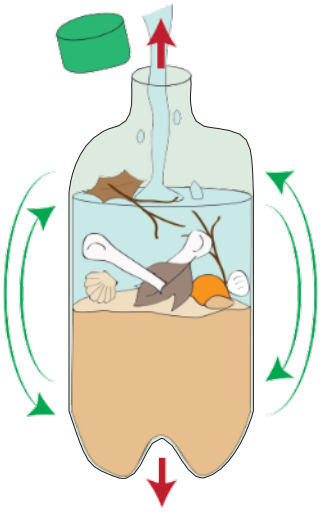


6 Observe the next day without disturbing the bottle. Record observations about differences in what has settled and describe the water clarity. Draw or take a picture of the bottle and its contents.

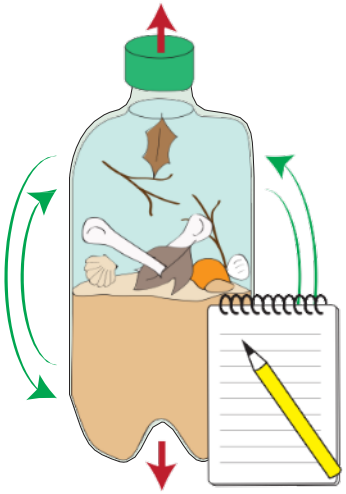
7 Shake the bottle multiple times for a day or two. Keep track of how many times storms occur. Also, make note of any significant changes in the sediments, settling rate, or water clarity.

8 After 1 to 2 days of storms, allow the bottle to rest undisturbed for 2 to 3 days. Make final observations.

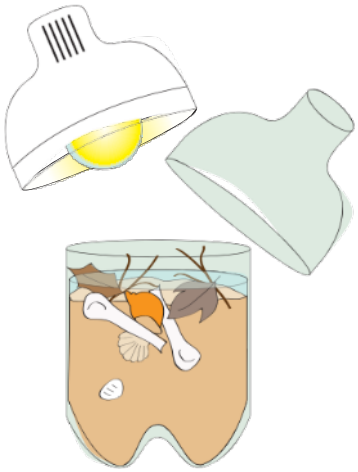
9 **This step should be done by an adult.** Take the bottle outside. Have an adult carefully make a small hole in the side of the bottle about 1-half inch above the sediment level. Try not to disturb the sediment during this process. Remove the cap slowly and let most of the water drain out. Cut off the upper half of the bottle about an inch above the top of the sediment. Carefully pour off the last of the water without disturbing the sediment.

10 Place the bottom halves of the bottles in a warm sunny area or under a lamp. Allow the sediments to dry completely. This will take about a week depending on temperature and humidity.

6—8



9–10

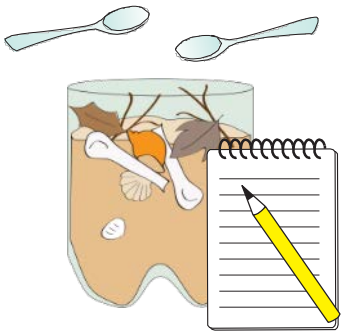


11 After the sediment has dried, it will be time to excavate (dig out) the fossils. Record observations of the sedimentary rock before excavating.

12 Place the dried sediment sample (still in the plastic bottle) on some newspaper. Using a spoon and a toothpick begin to carefully remove the sedimentary rock. Record all fossil discoveries. Draw a picture of them in situ (still in place in the rock) and record the depth at which they were found.

13 Clean up and dispose of the materials as instructed. Wash hands thoroughly.

11–12



Follow-Up Activities

- Identify the different depths that fossils and rocks were found in the sample. Compare results between individual students or groups by making a class chart of the different fossil depths. Are there any similarities or differences?
- Discuss the characteristics of the fossils that might explain the depth at which they settled.
- Compare sediment levels in the bottles of different students or groups. Look at differences in the number of layers, the order of the different layers, and the thickness and colors of the layers. Discuss what might cause any similarities and differences. Consider the types and amounts of starting ingredients and the number of storm events, etc.
- Discuss the following: Why are there many different layers in sedimentary rock? What can these layers tell us about the past? Why might different locations and time periods show very different sedimentary rock formations?
- Have students research the kinds of fossils that have been found in their local area. How old are they? What types of plants and animals inhabited the region in the ancient past? Based on the fossil evidence, how does the climate today compare with the climate when the animals or plants lived?
- In *Coyote and the Turtle's Dream*, the fossils were considered very valuable. Discuss what makes some fossils so valuable to collectors. Who was willing to pay money for them in the story? Which characters valued the fossils of the Great Turtle for other reasons?

Instructor Notes

Safety Note: *It is important for students to understand that organisms like bacteria live in soils, so they need to wash their hands with soap any time they touch the contents of the bottle.*

- Wide mouth bottles will be easier for the students to use.
- Plain kitty litter can be used for clay if you can't find a source of clay in your area.
- Dirt should be dried in an oven before giving to students in order to kill any living organisms. It helps to have a mixture of top soil and poorer quality soils to generate differently colored layers. Very coarse sand or small pebbles from the edge of a creek or river can be used in place of aquarium gravel.
- Bones need to be small enough to fit into the bottle opening and should be shorter than the width of the bottle so that they settle naturally. Chicken bones work well as long as you don't use the really light rib bones. Bones also need to be dried in an oven before giving to students.
- The twigs used must not be too light and must be shorter than the width of the bottle. If they float, they won't be good sedimentary material.
- Use metal spoons for the excavation. Plastic ones break easily.
- Explain that the salt was added to simulate ocean water. The salt helps hold the soil together to make the excavation a little more realistic. Also explain that real sandstone and sedimentary rocks are much harder because they were compressed under a large amount of pressure over many thousands of years. It's okay if the soil is not completely dry before excavating.

Online Resources

United States Geological Survey. School Yard Geology.
http://education.usgs.gov/lessons/schoolyard/RockSedimentary.html

Fast FAOS About Rocks and Fossils. Computer models of sedimentation.
http://www.childrensmuseum.org/geomysteries/faq1.html

Rock Hounds. Explore rocks, formations, and evidence of the past.
http://www.fi.edu/fellows/fellow1/oct98/index2.html

Virtual Fossil Museum. Fossil image galleries.
http://fossilmuseum.net/FossilGalleries.htm

Virtual Fossil Museum. More fossil images.
http://fossilmuseum.net/museum-fossils.htm

INVESTIGATION 3
WHY DO WE FIND FOSSILS IN UNLIKELY PLACES? MORE TECTONICS

Background for Teachers

In *Coyote and the Turtle's Dream*, Rain and his friends find the fossils of marine animal like clams, sea lilies, and sharks at Shell Ridge. Rain is fascinated by the idea that his house would have been under water in the past, especially since the ocean today is hundreds of miles from where he lives. There is, however, a very good explanation for why we find fossils in places we don't expect to find them. Again, the answer is in plate tectonics. Here is how it works:

When the earth's plates collide, they exert tremendous force and pressure on each other. Even though plates move very slowly, they have very large mass that causes great frictional forces to build up over time. The large mass of the colliding plates increases the momentum and friction between the plates.

Evidence of these collisions can be seen in earthquakes, volcanic eruptions, and mountain formation. The density of the colliding plates generally determines whether the process of subduction or uplifting occurs between the two plates. *Uplifting* occurs when the less dense plate travels over the top of a denser plate. The plates under the ocean are denser than plates on the land (continental plates)—so the continental plates tend to undergo uplifting. Uplifting is one method of mountain formation and can explain how the fossils of organisms that were once underwater end up on land at high elevations. The process of uplifting can be modeled using layered clay to simulate layers of sedimentary rock moving on a tectonic plate.

ACTIVITY
When Plates Collide

Duration: 30 minutes

Materials

- Four different colors of modeling clay or commercial play dough (to represent layers of sedimentary deposits)
- Pea gravel, aquarium gravel, or small beads (to represent fossils)
- 12 x 12 inch squares of plastic sheeting or cardboard covered in plastic wrap
- Wooden dowel or other round object for rolling out clay or dough

Procedure

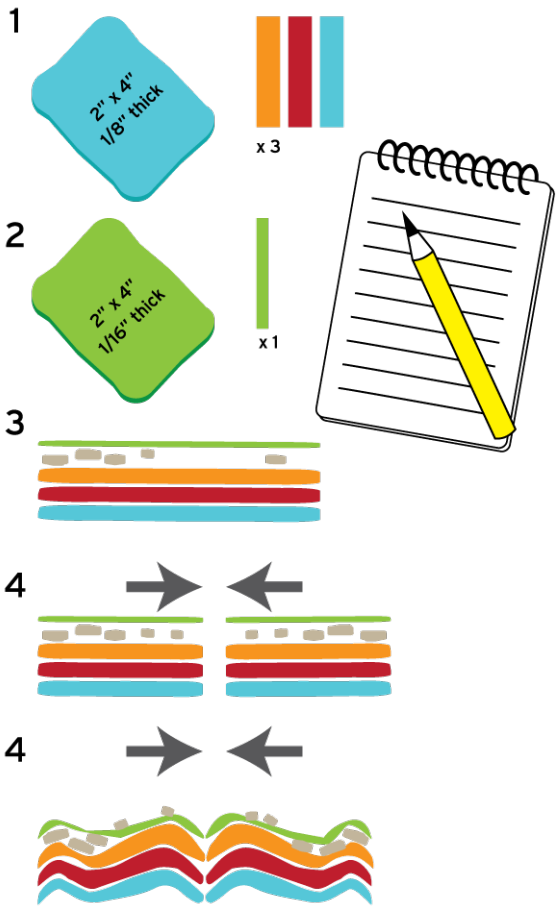
For each group or person

1 Roll out three colors of clay on the plastic sheet, each in a 2 x 4 inch rectangle about 1/8 inch thick. Use a pencil, pen, or wooden dowel as a rolling pin.

2 Obtain a fourth color of clay and roll it out into a 2 x 4 inch rectangle that is very thin—about 1/16th inch thick.

3 Stack the layers of clay with the thin layer on top. This will be your model of sedimentary rock. Place a few beads or gravel bits under the thin top layer to represent organisms that have died and been buried under layers of ocean sediment. It is best if they are placed near the end that will collide with another plate in Step 4.

4 Pair up with another group or student. Place the two "sedimentary rock" clay formations on their plastic sheets end to end about 2 inches apart. The sedimentary rock layers are now part of a "plate" on the earth's crust. With their hands, have students push the blocks of clay together to make them collide with some force. Record the deformations that occur by drawing a cross sectional diagram of the plate collision. Identify areas where uplifting occurred.



Follow-Up Activities

- Where are the "fossils" (beads) located after the collision of the two plates? How does this compare to where they were located before?
- Aquatic organisms fall to the bottom of a lake or ocean when they die and are buried in the sediment. They are then covered with more sediment over time. Discuss how pressure from the sediments and lack of oxygen promote fossil formation.
- Describe how plate movements and uplifting can create mountains and plateaus.
- Explain how fossils that were buried at the bottom of the ocean can be discovered in mountains. (Now students may understand how the Great Turtle [*Archelon ischyros*] was found near Red Water Mountain.)
- Research the Western Interior Seaway where the Great Turtle once swam to see what parts of North America used to be under water and when. Identify the types of plants and animals that existed during that time. How did the climate during the Cretaceous period compare to the climate today?
- What caused the Western Interior Seaway to dry up? When did this occur?
- Ask students if there is any evidence of tectonic activity (active or dormant volcanoes, earthquakes, or mountain building) in the area where they live. Are there any fault lines in their area? What is the relationship of fault lines to tectonic movements? Which geologic events do fault lines predict?

Online Resources

Endangered Earth: Ancient Sea Levels North America, Cretaceous.
http://www.thelivingmoon.com/41pegasus/02files/Global_Warming_002.html

United States Geological Survey. Sea level changes in the Western Interior Seaway.
http://geology.cr.usgs.gov/crc/fossils/ammonites.html

Map of the Western Interior Seaway.
http://www.fossilmuseum.net/fossil-art/maps/seaway/seaway100mya.htm

Towel Geology. Another way to show colliding plates using towels!
http://www.geosociety.org/educate/LessonPlans/TowelGeology.pdf

Instructor Notes

Homemade dough with food coloring can be used in place of modeling clay. Recipes for making homemade dough can be found at: http://www.bestrecipes.com.au/recipe/No-Cook-Play- Dough-L2119.html or http://prekinders.com/play-dough-recipes/

Science

INVESTIGATION 4
UNCOVERING THE PAST—EROSION AND WEATHERING

Background for Teachers

Shell Ridge on the Medicine Cave Indian Reservation must have been a wonderful place to explore. But with all its canyons, caves, and gullies, it would also be an easy place to get lost! When Rain, Boomer, and Simon go hunting for shark's teeth, Roberta, Rain's mom, cautions them not to climb too high on the Ridge and to stick on the edge of the "flats." In such a weathered environment, she knew that the rock and soil would not be stable, and that the network of ancient, eroded water channels through the sedimentary rock could lead into dangerous territory. Later in the story, it is Coyote that safely leads Rain and Simon to the "place where the giants sleep" and to the bones of the Great Turtle.

Without the natural processes of erosion and weathering that break down materials into smaller and smaller parts, Rain and Simon would never have been able to discover the fossils of the marvelous creatures in the cave. In nature, these processes are caused by wind, water, biological, chemical, and mechanical actions.

Have students look up examples of each type of process and compare them with eroded and weathered formations they find in their area. Also investigate how caves are formed and what types of weathering and geological events are involved. Then students can discuss why fossils are commonly found in caves and areas that show a large amount of erosion and weathering.

Even though these processes occur naturally, there are many human activities that contribute to these processes and increase their impact on the environment. The class can also think about and discuss possible human activities that contribute to erosion and weathering.

ACTIVITY
Weathering by Water and Wind

Background for Teachers

Weathering by rain, wind, and ice constantly erodes earth's land surface so that the resulting broken-down rock and soil are transported to the oceans. If it were not for the movement of the earth's crustal plates that makes new mountains, erosion would transport *all* the dry land on the planet into the oceans. Weathering is a powerful force that wears down mountains and carves out caves. Water and wind can also create strange and wonderful rock shapes like the photograph on this page of a sandstone sculpture. In this activity, students try their hand at weathering a "mountain."

Materials

- Sand
- Small rocks
- Plastic cups (2 per group)
- Straws (one per person)
- Rectangular pans (one per group)
- Water

Weathering by Water

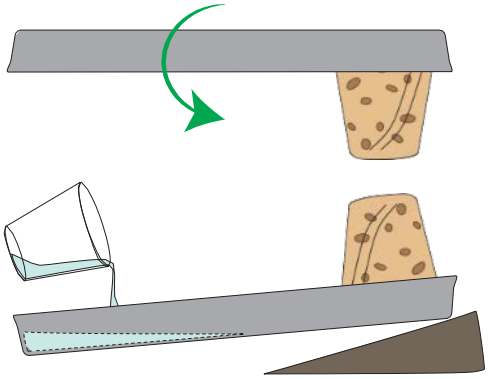
Duration: 60 minutes

Procedure: (For each group or person)

1. Fill a plastic cup with a mixture of wet sand and some small rocks (to represent hidden fossils). Place rocks randomly as you add sand. Pack the mixture tightly and completely fill the cup.
2. Place the rectangular pan upside down over the sand cup. Make sure the cup is close to one end of the pan (not centered). Holding the cup tightly to the pan, carefully invert the pan so it is right side up.
3. Place the pan with the sand cup at a slight angle on a table by putting a wedge of paper or wood under the end with the cup.
4. Carefully fill the low end of the pan with enough water to cover about 1/3 to 1/2 of the bottom of the pan. This will represent the nearest river or lake.
5. Carefully remove the cup holding the sand so that the sand mountain remains. Don't worry if there are slight cracks or small amounts of sand dislodged during this process. Let this structure set for about 30 minutes. Have students draw a picture of their mountain and lake.

1

2–4



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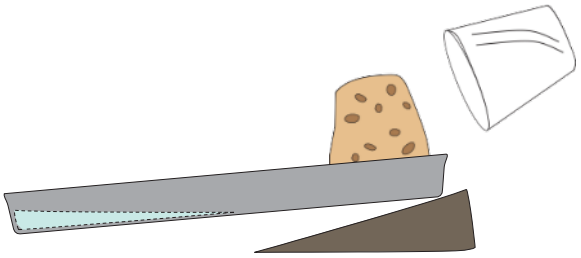


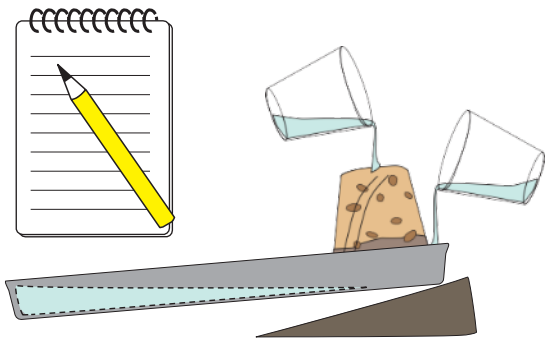
6 Simulate water erosion by very slowly pouring water from the cup over the top of the sand mountain. Repeat this procedure varying the location where the water is poured—starting on the side closest to the lake. Pour only a small amount at one time pausing between each addition.

7 Continue until you have significant weathering of the mountain. Pour small amounts of water until only half of the mountain remains. Record observations by drawing and describing changes in the mountain caused by the water. Note any fossils uncovered.

8 Observe and record what is happening to the lake.

9 Dispose of the sand and clean the pan according to the teacher's instructions.

6–8



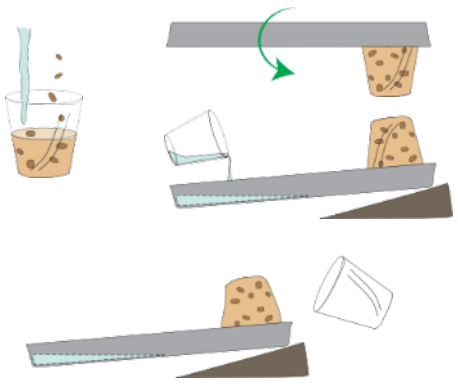
Weathering by Wind

Duration: 60 minutes

This activity is messy and should be done outside. (See Instructor notes!)

1 Repeat Steps 1-4 for Weathering by Water. However, the sand mountain will need to dry longer. It should set overnight (if left inside) or be set out in the sun for an hour if it is warm and dry.

1



2 Simulate wind action and storms by blowing on the sand mountain through a straw. Blow on the sand from the lake side of the pan. **If students are working in groups, they should be very careful to take turns blowing on the mountain. They should not blow sand toward someone else**. If goggles or eye protection are available, wear them.

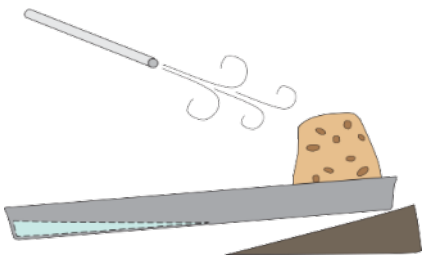
3 Change the location where the wind action is directed. Observe the difference when the wind is blown on the top surface and sides of the mountain. Record these observations by drawing changes in the mountain caused by the wind actions. Ask students to see if they can develop any shallow surface caves.

4 Continue this process until significant weathering and erosion of the mountain has occurred (at least one fourth or more of the mountain is gone).

5 Observe and record what is happening to the lake.

6 Dispose of the sand and clean the pan according to the teacher's instructions.

2



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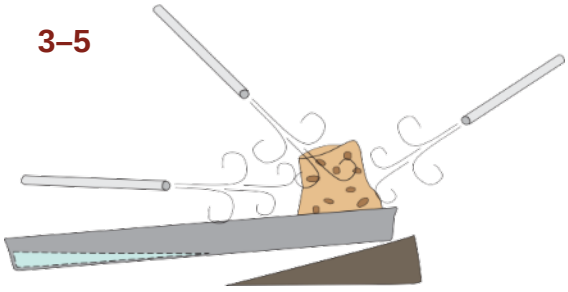


Follow-Up Activities

- Which occurs more quickly, weathering by wind or water? Have students provide evidence for their answers. Compare with other groups, did everyone have the same result?
- Were there any differences in weathering around cracks or the small rocks in the sand? If so, describe them and try to explain why this happens. Compare answers with others.
- The erosion caused by weathering causes loss of the mountain mass. What effect did this have on the lake? Can you explain how this process contributes to sedimentation and formation of sedimentary rocks?
- American Indians and Alaska Natives strongly believe in the balance of forces in nature. Explain how this balance can be evidenced in the processes of weathering, erosion, sedimentation, and mountain formation.
- Identify evidence seen in everyday life of weathering and erosion by wind.
- Identify evidence seen in everyday life of weathering and erosion by water.

Online Resources

Wind Erosion Movie Archive. Dust Bowl Storm Footage, Dune Sand in a Wind Tunnel, Close-up of Dune Sand in a Wind Tunnel, Dune Sand and Plants in a Wind Tunnel. http://www.weru.ksu.edu/vids/

Carlsbad Canyons National Park. Caves, Canyon, Cactus & Critters: Middle School Geology. http://www.nps.gov/cave/forteachers/upload/geology_ms_gravel.pdf

National Park Service. Ozark National Scenic Riverways Park: How Caves Form. http://www.nps.gov/ozar/forteachers/how-caves-form.htm

Weathering and Climate. Mechanical and Chemical Weathering. http://ees.as.uky.edu/sites/default/files/elearning/module07swf.swf

Cross-Curricular Connections

See Cross-Curricular Connections for more lessons about investigating the earth's history.

- **Science and English/Language Arts** — A Day in the Life of the Archelon
- **Science and Social Studies** — Protecting the Fossil Record
- **Science and Math** — Dating Fossils: Understanding Half-life

Instructor Notes

Students will need to be closely supervised, or this activity could be done as a demonstration by the instructor if there is concern about safety.

Safety Note: *The sand will blow around in the air. Students should wear safety glasses or goggles. Do not let two students blow on the sand mountain at the same time. Observers should stand behind the person blowing. Different groups should be far enough apart so they do not blow sand at each other. Having all groups blowing in the same direction and with the wind is strongly recommended. If sand does get in the eye, carefully flush with lots of water.*

- Have students work in pairs; each can make a sand mountain that they will use for the wind activity and the water activity.
- Students will need to let the sand mountains dry a bit before applying "wind." You might have them make both structures at the beginning of the activity so that the second sand mountain can dry while they weather the first with water.
- When students are blowing through the straws, they will need to blow hard. Taking turns is a good idea to prevent them from getting light headed. Also, they will need to hold the end of the straw close enough to move the sand, but not so close that they get sand blown back into their faces.

Science

PART 2: INVESTIGATING NUTRITION
YOU ARE WHAT YOU EAT

OBJECTIVES

- Evaluate the nutritional contents of foods in order to make healthy choices about the types and amount of foods consumed.
- Identify healthier alternatives to high-sugar and high-fat foods and how to incorporate these alternatives into cooking and food choices.
- Identify the role and effects of fat and sugar in the body.
- Explain how we need to maintain a balance between eating enough nutrients to be healthy, but not eating so much food that the amounts are excessive.
- Identify different types of carbohydrates, their structures, and their effects on the glycemic index.
- Understand the effects of food processing on the increase of simple sugars in foods, and explain why raw fruits and vegetables have a lower glycemic index, even when they are cooked.
- Compare fats and carbohydrates in different foods.
- Explain how increased portion sizes and a lifestyle of decreased activity have contributed to increased rates of obesity and type 2 diabetes.
- Be able to identify the different kinds of diabetes.

Background for Teachers

Rain and his friends are always trying to eat healthy foods and they are very physically active. In the story, they play basketball, chase down newspapers, explore Shell Ridge, and run after Coyote to discover the Great Turtle's cave. Arianna, who has type 1 diabetes, also knows a lot about eating healthy and playing sports. The kids remember very well the eagle's messages about good nutrition and exercising regularly to maintain a healthy lifestyle.

Our bodies need proteins, fats, and carbohydrates to provide the energy we need, and vitamins and minerals to keep our bodies functioning properly. The energy we don't use is stored mostly as fat for later use. Frequently, consuming more food calories than we use through activity or metabolic

processes will increase the amount of fat accumulating in the body. One key to health is keeping a balance between what we eat and how many calories we use.

It is important to understand the nutritional value of the foods we eat and the amount of calories we use in order to maintain a healthy balance in our bodies. Not all foods are created equally. They differ not only in the amount of calories, but also in the amounts of carbohydrates, fats, and proteins they contain. The nutritional profiles of foods are important to consider because fats provide 9 Calories per gram, while carbohydrates and proteins each provide 4 Calories per gram. (Note that Calorie with a capital C is a kilocalorie or 1,000 calories.) All three types of food are needed in the diet as they each have different functions in the body:

- Carbohydrates are the main energy source for metabolism.
- Proteins are needed for tissue building and energy.
- Fats are needed for cell structure, to insulate organs, and to store excess energy.

The key is to consume these foods in proper proportions, eating those that provide more calories in moderate amounts.

Awareness of the foods that provide us with the best nutrition is the first step. Taking action, like Rain and his friends did when they helped Boo to rearrange his store to help customers find healthy food choices, is also important. Not eating a balanced diet, controlling portion sizes, or getting enough physical activity can lead to a variety of health problems including type 2 diabetes and obesity.

Diabetes is a disease in which blood glucose levels are above normal. Most of the food we eat is turned into glucose, or sugar, for our bodies to use as energy. The pancreas, an organ that lies near the stomach, makes a hormone called insulin to help glucose get into the cells of our bodies. When someone has a form of diabetes, his or her body either doesn't make enough insulin or doesn't use its insulin as well as it should. This causes sugar to build up in the blood. We need some sugar in our blood at all times so it can be delivered to our cells where it is converted into energy But too much sugar in the blood, over time, can cause serious damage to the eyes, kidneys, nerves, and heart.

There are two main types of diabetes: type 1 and type 2. People with type 1 diabetes usually find out they have diabetes when they are children or young adults. The pancreas of a person with type 1 makes little or no insulin. Scientists are learning more about what causes the body to attack its own pancreas and stop making insulin, the hormone that regulates blood glucose. People with type 1 diabetes must inject insulin every day to live. Arianna in *Coyote and the Turtle's Dream* has type 1 diabetes. To survive, she must have insulin delivered by injection or a pump. This form of diabetes usually strikes children like Arianna and young adults, although it can develop at any age. Risk factors for type 1 diabetes may be autoimmune, genetic, or environmental. There is no known way to prevent type 1 diabetes. Healthy eating, physical activity, and insulin injections are the basic therapies for type 1 diabetes. The amount of insulin taken must be balanced with food intake and daily activities. People with type 1 diabetes must monitor their blood glucose levels frequently.

However, most people with diabetes—at least nine out of ten—have type 2 diabetes. The pancreas of people with type 2 diabetes keeps making insulin for some time, but the body can't use it very well. Most people with type 2 diabetes find out about their diabetes after age 30 or 40.

Some people at high risk for type 2 diabetes (and heart attack and stroke) have a condition called prediabetes. Individuals with prediabetes have blood glucose and/or A1C levels higher than normal, but not high enough to be classified as type 2 diabetes. They often have muscle, fat, and liver cells that resist using insulin properly. As a result, their bodies need more insulin to help glucose enter their cells. The pancreas tries to keep up with this increased demand for insulin by producing more. Eventually, the pancreas fails to keep up with the body's need for insulin. Excess glucose builds up in the bloodstream, setting the stage for type 2 diabetes. Many people with insulin resistance have high levels of both glucose and insulin circulating in their blood at the same time. But the good news is that people with prediabetes who eat a healthy diet, lose 7 to 10 percent of their body weight, and increase their physical activity may prevent or delay the onset of type 2 diabetes. If people do develop type 2 diabetes, they can help to control it by eating healthy, being physically active, and testing to assure that they are keeping their blood glucose levels balanced. In addition, they may require oral medication, insulin, or both to control their blood glucose levels.

People with diabetes, either type 1 or type 2, must take responsibility for their day-to-day care, and keep blood glucose levels from going too low or too high. They need a health care provider to help them monitor their diabetes and learn to manage it. People with diabetes may need endocrinologists who specialize in diabetes care, ophthalmologists for eye examinations, podiatrists for routine foot care, and dietitians and diabetes educators who teach the skills needed for daily diabetes management.

The last type of diabetes appears during pregnancy. It is called gestational diabetes. If not treated, it can cause problems for mothers and babies. Gestational diabetes develops in 2 to 10 percent of all pregnancies but usually disappears when a pregnancy is over.

In the past, it was rare for American Indians and Alaska Natives to develop type 2 diabetes. They ate a diet that had a good balance of healthy foods. The modern American diet has evolved to contain many processed foods and large portion sizes. Mass production has made foods that were "sometime" treats into "everyday" foods. Diets today contain much higher amounts of processed sugars and fats as well as the tendency to contain many more calories per meal. Because of the availability of processed foods, it can be much harder to eat a healthy balanced diet. Recently, some food companies have started to respond to this problem and are offering smaller packaging and healthier alternatives. However, care should be taken with foods marketed as "healthy alternatives." These "healthy" low-fat or low-sugar foods are not always healthy. Sometimes more sugar and salt are added to the low-fat foods to make them more appealing. Reading labels is important if we are to understand what we are eating.

Online Resources

Virtual Chembook: Energy for the human body.
http://www.elmhurst.edu/~chm/vchembook/592energy.html

Definition of Metabolism.
http://encyclopedia.kids.net.au/page/me/Metabolism

Kids' Games. Little D's and Arianna's Expedition Nutrition Games.
http://www.nutritionexplorations.org/kids.php

Nutrition for Kids. Activities/puzzles.
http://nutritionforkids.com/kidactivities.htm

INVESTIGATION 1
ARE ALL CARBOHYDRATES EQUAL?

Background for Teachers

Carbohydrates are compounds containing carbon, hydrogen, and oxygen. The body burns these compounds to provide energy for our bodies to grow and function. There are three main types of carbohydrates found in foods: sugars, starches, and cellulose. Sugar in the form of glucose is needed to provide the energy that fuels our bodies. The general chemical equation that describes this reaction is:

$$C_6H_{12}O_6 + 6O_2 \Rightarrow 6CO_2 + 6H_2O + 263 \text{ kcal } \textit{or}$$

Glucose + oxygen => carbon dioxide + water + energy

Our cells use glucose, a simple carbohydrate also known as a simple sugar. Complex carbohydrates like starch and cellulose are made up of long chains of simple sugars and must be broken down before they are used as fuel by our cells. Complex carbohydrates supply energy in addition to cellulose (commonly called dietary fiber that is not digested, but aids in digestion) and other nutrients. The bonds that hold the complex carbohydrates together are broken down by enzymes and/or heat and acids. The digestive system supplies enzymes in saliva and acids in the stomach. Cooking provides heat and creates acids that break down the bonds as well. Because complex carbohydrates are composed of hundreds or thousands of chains of simple sugars, it takes the body longer to digest them (break down their bonds). The sugars from complex carbohydrates usually move more gradually into our bloodstream than simple sugars. However, grains or other starches that are highly processed or refined break down into sugar very quickly because they are mechanically pre-digested. In contrast, grains or legumes that remain whole, such as brown rice or beans, digest more slowly.

One way to determine the effect of carbohydrates on our blood glucose levels is by using the glycemic index (GI). The GI is a ranking of carbohydrates on a scale from 0 to 100 that indicates the extent to which they raise blood sugar levels after eating. Foods with a high GI are those which are rapidly digested and absorbed. They result in a rapid rise in blood sugar levels. Foods with a low GI, because they are slowly digested and absorbed, produce gradual rises in blood sugar and insulin levels. Low GI diets have many health benefits. They help to control weight because they help control appetite and delay hunger, and they been shown to improve blood glucose levels in people with diabetes (type 1 and type 2).

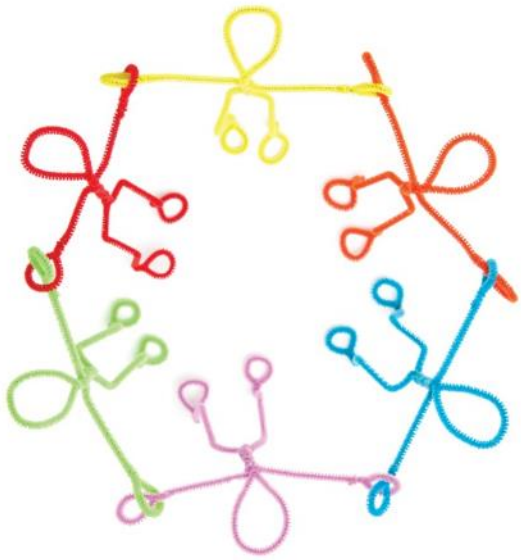
ACTIVITY 1
Making Sugar and Starch

Duration: Variable

Background for Teachers

There are several ways that teachers may approach the activities in this investigation:

- The procedure described in Steps 1-3 can be followed by middle school students constructing their own sugar and starch molecules. However, these steps would probably be most appropriate for an advanced middle school class or a high school class.
- To shorten and simplify the lesson, teachers or high school students and other volunteers may assemble the molecules for use by small groups of middle school students. Although the 18 molecules required for each group are pre-assembled, the concept that simple and complex carbohydrates are not equal can be demonstrated in Activity 2 when middle school students "digest" the molecules by taking them apart.
- This investigation will also work well as a teacher demonstration or as a class demonstration presented by a small group of students. This approach will reduce the need for multiple sets of molecules.



Materials

- Thirty-six pipe cleaners. Three 12-inch pipe cleaners (fuzzy sticks) of a single color will be needed to construct one glucose molecule. (A minimum of 18 molecules will be needed for each group of students to complete Activity 2.)
- Colored markers (Choose three colors that are different from the color of the pipe cleaners.)

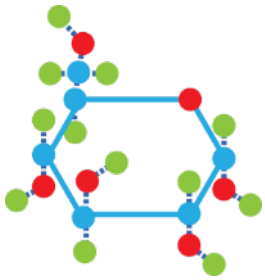
Procedure

1 "Molecule constructors" will make molecules of a monosaccharide (a simple sugar) to represent glucose. Follow the directions in Appendix 1 to construct 18 glucose molecules. Set aside six glucose molecules for Activity 2.

2 Next, the molecule constructors will make a disaccharide from two glucose molecules. Use the remaining twelve molecules from Step 1 to make six disaccharides. Examples of disaccharides are sucrose (table sugar), fructose (fruit sugar), maltose (malt sugar) and lactose (milk sugar). Twist two glucose molecules together to simulate one disaccharide molecule—in this case, maltose. (Malt sugar is often added to milk shakes. A milk shake made with malt sugar is called a "malt.") Set aside three disaccharide molecules for Activity 2.

3 Connect the three remaining disaccharide molecules using the same method as in Step 2. It will make a chain of six glucose molecules. Now we have a starch! Set aside for Activity 2. (Teachers should keep in mind these are simplified models and do not actually reflect the complexity of starch molecules. Real starches would have chains of about 300-600 monosaccharide molecules.)

1



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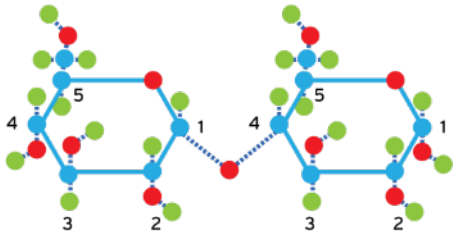

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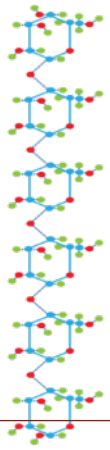


ACTIVITY 2
Digesting Sugar and Starch

Duration: 30 minutes

Materials

- Six individual monosaccharide (glucose) molecules; three disaccharide molecules composed of two glucose molecules each; and a chain of starch composed of six glucose molecules.
- Three buckets or paper bags

Procedure

1. Divide the class into several groups of three, depending on the number of students in the class. In each group of three, one student will have the monosaccharide molecules; one student will have the disaccharide molecules; and one will have the starch molecule. The students will pretend to be parts of the digestive system (enzymes in saliva and acids in the stomach) that help extract glucose from more complex carbohydrates like the disaccharides and starches.

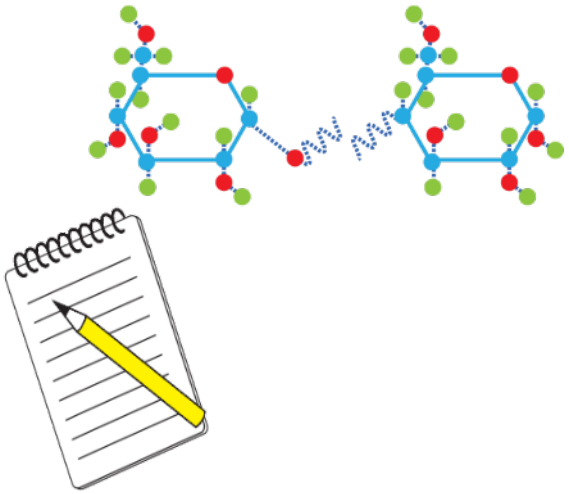
2. Give each group a paper bag representing the blood stream.

3. Review or discuss the structure of the glucose molecule. Instruct the students to break the bonds between the glucose molecules at the point where the pipe cleaners are twisted together. (If the students did not construct the molecules themselves, indicate where this bond is located.) Caution students not to pull apart the glucose molecules themselves.

4. Each student should begin "digestion" at the same time. The goal is to see which students fill their bags with glucose molecules first. (Of course, students with the six individual glucose molecules can fill their bags immediately. The others will take longer to disassemble their more complex carbohydrate molecules.)

   Ask students why the students digesting the individual glucose molecules were able to dump them into the blood stream right away. Which molecule(s) entered the blood stream the slowest? Why?

2–3



Follow-Up Activities

- Discuss how carbohydrates of different complexity have different effects on blood glucose levels.
- High heat and acids can also break down the bonds between the monosaccharides in starches. Predict how cooking vegetables might affect the glycemic index of those foods. Look up the glycemic index of raw verses cooked forms of some vegetables. Do the data support the student's predictions?
- Prior to the introduction of foods and cooking methods from other parts of the world, Native Americans consumed a higher percentage of raw or less processed foods. Discuss why this is considered to be healthier. How does cooking affect the digestion of carbohydrates?
- Today's modern diet contains many packaged processed foods. Research how these foods are prepared in factories. Besides the loss of nutrients that can occur by over-processing foods to produce a long shelf life, how might the processing affect the glycemic index of these foods?
- The online resource below shows a table of foods by glycemic index and glycemic load. Some foods have sugars and starches that are broken down more quickly than others. Which of the foods on the list contain sugars and starches that are broken down the fastest? Which ones the slowest? What kinds of sugars and starches (simple or complex) do you think the high GI foods contain? Which kinds do the low GI foods contain? Discuss how this information might affect your food choices. Have students research the difference between the glycemic index and the glycemic load.
- Based on what you have learned about type 1 and type 2 diabetes, which kinds of carbohydrates would be a problem for persons with diabetes?

Online Resources

Glycemic index and glycemic load for 100+ foods.
http://www.health.harvard.edu/newsweek/Glycemic_index_and_glycemic_load_for_100_foods.htm

Science

INVESTIGATION 2
SUGAR AND FAT CONTENT IN FOODS

Background for Teachers

Rain, Boomer, Hummingbird, and Simon believed it was really important to educate tribal members about the ingredients in the foods they eat. Eager to improve the health of their community, they set up a label reading project during the summer at local groceries stores. Rain, of course, checked out what was in the pots every night at supper, and he really gave his mom grief when she bought the can of tomatoes that had 50 percent of the daily allowance of salt in one serving!

Many foods naturally contain sugars, sodium (salt), and fats as they are essential components of a healthy diet. Unfortunately, many foods in the modern diet contain *added* fat, sodium, and sugar that can result in unhealthy amounts of each in our overall diet. It is important to read the Nutrition Facts on food labels to understand how much fat, sodium, and sugar we are really eating.

There are many products marketed to health conscious individuals that are lower in fat, sugar, and sodium. Look at labels for these types of foods and compare them to labels of similar foods that are not advertised as low-sugar, low-fat, or low-sodium. Students may notice that many times when the fat is lower the total carbohydrates are higher. In order to make healthy food choices, we need to be educated about sugars, sugar substitutes, salt (sodium), fats, and fat substitutes.

ACTIVITY
Sugar and Fats Revealed!

Duration: 30-45 minutes

Background for Teachers

Teachers may choose to demonstrate this activity or have a group of students demonstrate several snack products to the rest of the class. This alternative may be preferred to save expenditure on food materials required for the activity. If the school has rules against bringing food items into the classroom, teachers can photocopy food labels of popular snacks, treats (including dairy treats), and sodas. Nutrition Facts for most foods (including fresh fruits and vegetables) and snacks by brand are available online.

Materials

- Sticks of fat (butter, regular margarine, or shortening) cut into 1 tablespoon portions
- Sugar cubes (4 gram size) or granulated sugar (1 teaspoon of granulated sugar equals one sugar cube)
- Packaged or canned snacks and treats such as candy, cookies, or chips
- Canned or bottled soda
- Measuring spoons
- Cups

Procedure

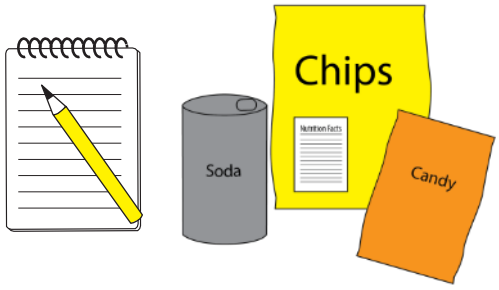
1 Each student (or a group) should choose packaged or canned snacks, treats, and/or sodas to bring to class.

2 For each snack item read the label to find out the number of grams of sugar and total fat in a serving. If the serving size is 1/2 cup, but students would normally eat 1 cup or more, use that portion size to reveal the amount of sugar or fat that they are really eating. (Students may need some assistance with the calculations.) Do the same for the sodas (in ounces or milliliters) to reveal the amount of sugar consumed.

3 Translate the amount of fat in the portion size into the equivalent amount of fat cubes. Measure out the correct number of fat cubes (1 tablespoon equals one cube) in the item. (Use nearest whole number, do not cut cubes smaller.) Each cube of fat (1 tablespoon) is about 11 grams and represents between 100-110 Calories of fat.

4 Measure out the number of sugar cubes represented in the food item or put the equivalent amount of granulated sugar into a cup. (Use nearest whole cube equivalent.) Each cube (1 teaspoon) of sugar is 4 grams or about 15 Calories.

1–2



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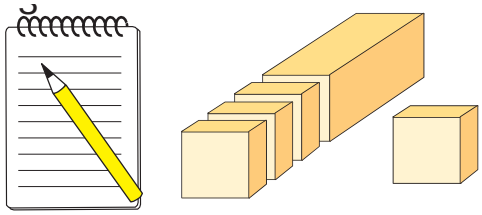

1 pat = 11 grams = 100 Calories

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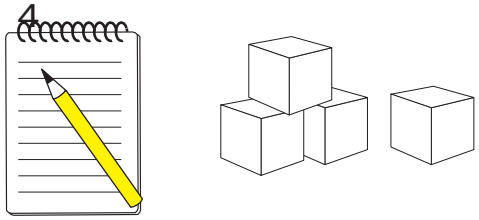


1 cube = 4 grams = 15 Calories

Follow-Up Activities

- Invite the class to discuss their expectations about the amounts of sugar and fat in the snacks, treats, and sodas. Were students surprised by the amounts?
- Examine the Nutrition Facts information on the packages of the snacks and treats and cans of soda in regard to the Percent Daily Values recommended based on a 2,000 Calorie diet. What percent of the recommended daily amounts do the snacks and sodas represent for Total Fat, Total Carbohydrates, and Total Sodium? Have students research Nutrition Facts online for various fruits, vegetables, and other healthier food choices. What percent of the recommended daily amounts do the healthier food choices represent?
- Rain's Challenge: Have student groups research online for natural alternatives to fats and sugars that can be used in recipes (like egg white substitutes and apple sauce instead of sugar). Choose their favorite recipes and brainstorm how they might alter the recipe to reduce the amount of fat and/or sugar. Make the new recipe at home. Share the results with the group, making sure to identify the substitutions used, why they were chosen, and the effect on taste and texture.
- Prepare a report on the healthiest and unhealthiest fast foods. There are several Web sites online that provide access to different fast food restaurants and the Nutrition Facts on hundreds of menu items.
- Find examples of food and snack advertising and promotion online, in magazines, or on TV. Note the sources of this information and discuss as a group which sources would be more reliable or trustworthy. Discuss how marketing might affect your choices and how you can use this information to be a smarter consumer.

Note: The Federal Food Administration (FDA) sets the Recommended Daily Intake (RDI) that is used in nutritional labeling. The RDI for Total Fat = 65 grams; for Sodium =2,400 milligrams; and for Total Carbohydrates =300 grams. The FDA does not set guidelines for sugar consumption, but Nutrition Facts labels do provide grams of sugar content per serving amount. The 2010 Dietary Guidelines Advisory Committee has recommended that no more than 5-15 percent of total dietary energy should be derived from solid fats and added sugars (soFAS). Solid fats (soF) are those solid at room temperature and added sugars (AS) are sugars and syrups that are added to foods or beverages when they are processed or prepared. Milk, vegetables, and fruits naturally contain some sugar, but added sugars are considered "empty calories" because they provide no nutritional value.

Online Resources

US Department of Agriculture. Dietary Guidelines for Americans.
http://www.cnpp.usda.gov/Publications/DietaryGuidelines/2010/DG2010Brochure.pdf

Choosing Healthy Fats.
http://www.helpguide.org/life/healthy_diet_fats.htm

A Healthier You. Recipe substitutions.
http://www.health.gov/dietaryguidelines/dga2005/healthieryou/html/tips_healthy_subs.html

Nutrition for Kids. Healthy recipes.
http://www.kidsgethealthy.org/resources/

Science

INVESTIGATION 3
HOW MUCH SHOULD WE EAT—PORTION CONTROL

Background for Teachers

Obesity and type 2 diabetes are increasing in our country at a time when people are eating more, and technology and lifestyle choices are influencing us to be less active. This phenomenon is compounded by the fact that many of the foods we eat are less nutritious and loaded with sugars and fats. One way to combat this problem is to develop an awareness of how much we eat and how much we really *need* to eat to be healthy and maintain an optimum weight and health. People also need to get the right amount of physical activity to help them stay healthy. Teachers may ask students to research how portion sizes have increased in the fast food industry in the United States. Or students may talk to family members to see if they have noticed how portion sizes of meals, sodas, and snacks have increased in restaurants and convenience stores. Students will then be prepared to discuss what factors may have contributed to these trends.

The first step in understanding the effect of how much we eat is to understand the Calorie. A Calorie is a unit of heat. It is the energy needed to raise the temperature of 1 gram of water to 1° C. A nutritional Calorie (with a capital C) is the unit of energy we use in determining the energy content of foods. The Calorie reported on food labels is actually a Kilocalorie, which equals 1,000 actual calories. A food Calorie would be the amount of energy needed to heat 1,000 grams (about a quart) of water to increase the temperature by 1^0 C (about 2^0 F).

Discuss with students how differences in energy needs may be based on gender, age, and lifestyle. Students may have noticed that members of the same family who eat similar foods can have very different weights and amounts of body fat. Some people use calories more efficiently than others based on their metabolism. People who get regular physical activity tend to burn calories more efficiently than those who get little physical activity. People with less body fat tend to burn calories more efficiently as well. There are also genetic components to the efficiency with which we burn and store calories. A person's metabolism determines how efficiently he or she burns and stores calories as well as extracts nutrition from foods. Differences in metabolism help explain why people getting the same amount of physical activity and eating the same diet in the same amounts will lose or gain weight at different rates.

ACTIVITY 1
Determining the Calories We Need

Duration: 30-60 minutes

The amount of calories a person needs per day depends on many variables. Have students research the following questions online:

- Look up the average number of food Calories needed per day for adults. Daily Calories for boys and girls, aged 9 – 13 can be found at: http://www.netwellness.org/healthtopics/obesity/aaprecommendations.cfm.
- Discuss why there is a difference for males and females.
- Discuss why daily caloric needs are presented as a range.
- Predict which factors may determine how many food Calories an individual would require on a daily basis.
- Discuss which factors students think they can influence by the choices they make versus those that they have difficulty controlling or can't control.

ACTIVITY 2
Comparing Calories

Background for Teachers

A fascinating Web site, "What Does 200 Calories Look Like," compares the amount of various foods and beverages that yield 200 Calories of energy: http://www.wisegeek.com/what-does-200-calories-look-like.htm. Two hundred Calories was selected because some foods are so calorie-dense (like oils) that 100 Calories would yield a very tiny portion size.) Have students compare the Calories in favorite snacks and treats with the portion sizes of various solid foods such as fruits and vegetables, bread and cereals, and cheeses presented on the Web site. As in Investigation 2, this activity may be more suitable to a teacher or group demonstration in order to control costs and follow school policies.

Materials

- Selected food items (non-snacks) from the "What Does 200 Calories Look Like" Web site.
- Favorite snack foods and treats
- Balance (or a kitchen scale that measures in grams)
- Cup and spoons
- Paper plates of the same size

Online Resources

Understanding Obesity and Weight Management. Dietary guidelines for children, including children of middle school age.
http://www.netwellness.org/healthtopics/obesity/aaprecommendations.cfm.

Healthy Eating Food Plate.
http://www.hsph.harvard.edu/nutritionsource/index.html.

Nutrition for Everyone. Nutrition Basics.
http://www.cdc.gov/nutrition/everyone/basics/foodgroups.html

Procedure

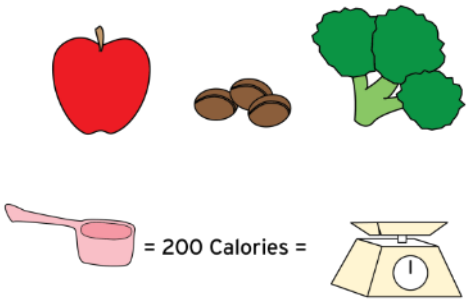
1 Divide the class into groups and have each group select some non-snack food items. Include peanut butter, nuts, eggs, and solid dairy products like cheese.

2 Measure out the appropriate number of grams for each selected non-snack food that represents 200 Calories using a balance. Place it on a paper plate.

3 Use the package information for the snacks (chips, pretzels, crackers, etc.), and treats (cookies, cakes, and candies) to determine the amount that would equal 200 Calories. For instance, the Nutrition Facts on a popular brand of potato chips notes that the package contents weighs 1 ounce (28 grams) and yields 150 Calories. Two hundred Calories would weigh approximately 37 grams. (Use a simple algebraic relationship to determine the weight: 28 grams x 200 Calories/ 150 Calories = 37.3 grams.) Weigh out the snack amount in grams on the balance and place on a paper plate of the same size. Now compare with non-snack foods!

4 Have each group share their portion comparisons with the class. Discuss the most surprising results.

1–2



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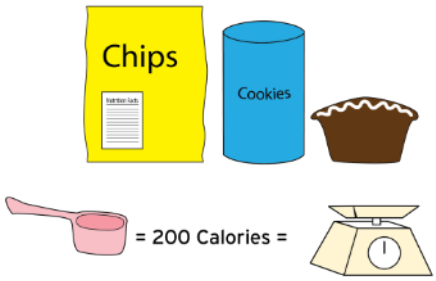

Follow-Up Activity

Look at a representation of the USDA recommended food pyramid and the new food plate at Choosemyplate.gov. Discuss how the comparison of equivalent Calories between foods relates to those recommendations. Many diets allow us to eat large amounts raw vegetables and fruits. Discuss why this recommendation is beneficial and helpful in controlling hunger. (**Hint:** Remember the benefits of complex carbohydrates!)