The Skeleton and Muscles

Teacher Notes: This is a vocabulary heavy topic. Younger students shouldn’t even try to memorize many of the bone names unless they’re very motivated, but older students may enjoy doing it. Playing games like the "Simon Says" activity may help if this is your goal for this topic. This topic's activities are all about building models. Some of the models of joints, bones and muscles are extremely simple and you'll be able to build a bunch all in a row, but don't try to do them all. If you can, the bone dissection is the best activity for really understanding bones, preferably with a larger bone. Of the books, the Steve Jenkins book is very new and well-done for older students.

Key Concepts

The skeleton is made up of bones that support your body. The bones are attached with different types of joints that allow different types of movement.

Bones are not solid masses, but have different tissue and are the place where blood cells are made. Bones are a living part of your body.

Muscles are stretchy tissues that allow us to move. Pairs of muscles working together contract and relax to move our limbs.

Some muscles are voluntary, which you control, and some are involuntary, which act automatically.

Vocabulary

| skeleton | ulna |
| bone     | tibia |
| joint    | fibula |
| vertebrae| patella |
| skull    | humerus |
| muscles  | clavicle |
| tendons  | carpels |
| voluntary| tarsals |
| involuntary| ribs |
| contract | mandible |
| pelvis   | sternum |
| femur    | biceps |
| radius   | triceps |
Books

Simpler Books

*Bones* by Anna Sandeman

*The Skeleton Inside You* by Philip Balestrino and True Kelley

*You Have Healthy Bones (Rookie Read-About Health)* by Susan Dekazarian

*You Can't See Your Bones with Binoculars* by Harriet Ziefert and Amanda Haley

More Complex Books

*Bones* by Seymour Simon

*Muscles* by Seymour Simon

*Muscles (The Amazing Human Body)* by L. H. Colligan

*The Search for the Missing Bones (Magic School Bus Chapter Book)* by Eva Moore and Ted Enik

*Skeletal System (The Amazing Human Body)* by Karen Haywood

*Bone: Skeletons and How They Work* by Steve Jenkins

Books with Activities

*Build a Skeleton Sticker Book* by Patricia J. Wynne

*Watch Me Grow: Fun Ways to Learn About Cells, Bones, Muscles, and Joints* by Michelle O'Brian-Palmer

Fiction and Cross-Subject Tie Ins

*Dem Bones* by Bob Barner

*Cinderella Skeleton* by David Catrow and Robert San Souci
A retelling of Cinderella with skeletons.

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Georgia's Bones by Jen Bryant
This easy picture book biography about artist Georgia O'Keeffe shows her love of shapes, including the shapes of bones.

The Gigantic Turnip by Alexei Tolstoy and Niamh Sharkey
This classic folktale about a turnip that requires a lot of muscles to pull has several editions with different tellings and illustrations, as well as variations about other vegetables.

Videos

Short Videos

“Skeleton” from Brainpop
http://www.brainpop.com/health/bodysystems/skeleton/

“Joints” from Brainpop
http://www.brainpop.com/health/bodysystems/joints/

“Broken Bones” from Brainpop
http://www.brainpop.com/health/diseasesinjuriesandconditions/brokenbones/

“Muscles” from Brainpop
http://www.brainpop.com/health/bodysystems/muscles/

“Them Not So Dry Bones” by School House Rock via YouTube
http://www.youtube.com/watch?v=CXho5IhfW2o

“Bare Bones” from National Geographic via Youtube
http://www.youtube.com/watch?v=GQedanwEfHY

“Skeletal and Muscular System Explained Thru Animation” via Youtube
http://www.youtube.com/watch?v=uxBe-BgmNTs

Movies and TV Episodes

“Bones and Muscle” Bill Nye the Science Guy


“The Bones and the Skeleton” Once Upon a Time... Life
http://www.youtube.com/watch?v=R1y85xeHsYE

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Other Resources

Small Human Skeleton Model

Activities
Quick and Easy Activities

Joints

Materials: none

Why: There are a total of 360 joints in the human body! Just take a little time to observe your own body's joints.

Procedure: Note the different joints you can find. Where are they? How do they differ? In what directions do they allow movement? Do you think there are joints you can't see? Where might they be? Which joints do you use the most? Which joints move the freest? Which joints are the most constricted?

Extensions: There are three types of joints in the human body: fibrous joints which don't move (such as in the skull), cartilaginous joints which move slightly, and synovial joints which move freely. Most of the joints in the human body are synovial. There are six types: hinge, pivot, ball and socket, saddle, gliding, and condyloid. Look up the characteristics of each joint and make a chart. Can you correctly observe and identify which joints in your body fit into each category?
The Stuck Finger Trick

Materials: none

Why: Our muscles are amazing, but their movement is limited by our bones and tendons. In this case, the tendons in your ring and middle finger are connected, limiting movement.

Procedure: Put your hand on a table with your middle finger bent under. Lift your thumb, then your pointer, and finally your pinkie. Next, try to lift your ring finger. Will it move? You can see the opposite action by holding your hand up and bending each finger. Which fingers move when you try to bend each of your fingers in turn?

Extensions: Can you find other muscles that are connected and refuse to move independently? How about in your foot? How about your eyebrows? Can you lift just one?

Flex

Materials: none

Why: You can feel your muscles contract and relax.

Procedure: Hold up your arm. Place your opposite hand on your upper arm so you can feel your thumb is on top of your biceps and your fingers below can feel your triceps. Flex your muscles and observe the relationship between the two muscles. Can you feel them contract? What happens to the biceps when the triceps contracts and vice versa?
Voluntary vs. Involuntary

Materials: none

Why: There are two types of muscle movement in the human body: voluntary and involuntary.

Procedure: First, do several voluntary movements of your choosing. For example, do a jumping jack, wiggle your tongue, or shake your head. What muscles did you use? Did you move exactly when and how you wanted? Next, observe some involuntary movements that your body is doing. For example, your heartbeat or your breathing. Can you stop doing them? Finally, you'll trigger involuntary movement. Can you stop yourself from blinking if someone waves their hand as if they're going to touch your eyes (be careful not to actually poke anyone in the eye!). Even if you know they won't do it, can you keep yourself from blinking? Now see if you can make someone's patellar reflex work. With the side of your hand (don't use a hammer unless you happen to have a special medical hammer designed for this purpose!) hit just below the knee while the person is seated with their legs hanging down. Do their muscles respond?

Extensions: Make a chart of different movements for your science journal. Which ones are voluntary and which are involuntary?

Stretchy Cells

Materials:
an dozen rubber bands

Why: Muscle cells stretch. This activity lets you make a very simple model of a chain of muscle cells.

Procedure: Make a simple chain with the rubber bands by looping each one together. Each rubber band represents a muscle cell. Once the chain is finished, pull the chain and watch the muscle cell model stretch out. When you move, this is what your muscles do. Then release the chain. This is what your muscle do when they contract.
More Involved Activities

Simon Says

Materials:
none, but a diagram of the bones and muscles might be helpful

Note: This activity can be played with just a parent and child, but works well in a group.

Why: It’s not absolutely necessary for kids to memorize the names of every bone and muscle in the body, but it's nice to become familiar with them.

Procedure: One person acts as Simon while everyone else follows the commands. Remember that when the Simon doesn't say, “Simon says...” then no one should do what he asks. Instead of giving traditional commands, the Simon should give commands that use the bones and/or the muscles. For example:
* Simon says flex your biceps.
* Simon says move your patella.
* Simon says shake your gluteous maximus.
* Simon says point to your sternum.

Tired Muscles

Materials:
old fashioned bathroom scale (not a digital one)
pencil and paper or science journal
timer

Why: Your muscles will grow tired when they've been used.

Procedure: Use your hands to squeeze the scale as hard as you can. Record the force of your grip. Next, make a fist and hold it for a full minute. Then repeat. Did your grip change?
Vertebrae Model

Materials:
- plastic straw
- string
- scissors

Why: This is the simplest model you can make of how the spine is constructed.

Procedure: Snip the straw into multiple pieces then thread them on the string. Bend and observe. How is the model like the spine?

Extensions: This is a very simple model. There are many ways that it is not like the spine. How could you make a better model? Consider using other materials, such as spools, egg carton pieces, buttons, or something else. Are there ways to make a model that won't bend in every direction, just like your real spine?

Ball and Socket Joint Model

Materials:
- ball
- disposable cup
- modeling clay or tape
- popsicle stick

Note: You'll need to match your ball to your cup. The ball should fit in the cup, but not too snugly. If you have a very small ball, consider a ketchup cup or a small paper cup. If you have a larger ball, you can get a larger plastic cup. If you need to, you can make a cone cup from paper that is sized just right for your ball.

Why: This is a simple model of a ball and socket joint and should show roughly how it works.

Procedure: Once you've made sure your ball and cup fit loosely together, use clay or tape to attach the popsicle stick to the top of the ball in order to rotate it in the “joint.” How is this like a real ball and socket joint?

Extensions: If you've used a plastic cup, see how friction comes into it. You can add oil to see if it moves more freely. In our bodies, there is also oil for our joints, called synovial fluid.
Two More Joint Models

Materials:
two small blocks (or substitute)  
rubber band  
pencil  
paper  
scissors  
tape

Why: This will make simple models of two joints, the gliding joint and the hinge joint.

Procedure:
1. To make the gliding joint, place the two blocks together and bind them loosely with the rubber band. Push the two blocks back and forth against each other. How is this like a gliding joint?
2. To make the hinge joint, cut two strips of paper. Bend each one around the pencil and attach it to itself with tape so it can move in a circle freely. Move each strip of paper back and forth. How is this like a hinge joint?

Label Me

Materials:
small shorts  
short sleeved shirt  
washable marker, such as Crayola  
diagram of the major muscles  
soap and water (optional)

Why: Why label the muscles on a worksheet when you could label yourself!

Procedure: Using the washable marker and wearing small clothes that allow more of your skin to show, label the major muscle groups right on your skin. You can walk around with them all day, or wash them off when you finish.
Make a Skeleton

Materials:
printer
cardstock
hole punch
brass brad fasteners
 glue
pen (optional)

Why: Having a large visual reminder of what you're studying is fun.

Procedure: Print out a large skeleton template onto cardstock and cut out each piece. You can find a simple template here, though there are others available: http://www.gamescraftscoloring.com/crafts/halloween_skeleton.htm
Once you have all the pieces, use the glue to attach the bones and the brass fasteners to attach the joints so your skeleton will move. When you finish, you can label the names of the bones.

Variations: This activity doesn't have extensions, but there are other variations. Instead of attaching the bones with brads so they move, use a large piece of paper to have a partner draw an outline of your body. Then glue the bones inside where they would be so you can see them inside you. Or if you can't get wire brads, just glue the bones down, preferably on a dark paper. Cardstock is not needed in these variations.

Bone Model

Materials:
cardboard
thin foam or substitute such as packing material, rubber shelf liner, or thick felt cloth
pompoms or substitute such as balled up tissue papers (preferably red and yellow)
tape
scissors

Why: We think of bones as solid masses, so the purpose of this model is to show the different parts of the bone.

Procedure: Cut the cardboard into a rectangle about 5-6” wide. How long it is can vary. Use tape to turn the cardboard into a hollow tube. This is the compact bone, which is hard. Next, roll up the thin foam to sit inside the cardboard. This is the spongy bone, the inner layer. Finally, add the pompoms to the center. These represent the bone marrow. If you're able to use red, it can represent the red marrow, which produces blood cells. The yellow represents the yellow marrow, which stores fat.
Arm Model

Materials:
- sturdy cardboard
- two rubber bands
- scissors
- tape
- brass brad or fastener
- hole punch or awl
- pen (optional)

Why: This model shows how the muscles in your arm work together.

Note: There are several variations of this model. In others, you can use paper towel tubes along with balloons or popsicle sticks instead of cardboard.

Procedure:
1. Cut two pieces of cardboard approximately 6” long and 1” wide. One piece will be the humerus and the other will be the ulna/radius. You can label the bones and draw on the ulna/radius to indicate that this is actually two bones with a small space in between them. Take this opportunity to feel the bones in your own body. If you feel the ulna and radius, you can feel that space.
2. Use the hole punch to put a hole into the humerus just 1/2” from the end. Then use the hole punch to make a hole in the ulna/radius 1 1/2” from the end.
3. Attach the bones together with the brad. Test that it can move freely. Now you have an “elbow.”
4. Cut each rubber band so they're each a string.
5. Tape the two rubber band strings to the end of the humerus.
6. Stretch each rubber band toward the elbow and attach one to the back of the elbow. This is your triceps. Attach the other to the other side of the elbow. This is your biceps. Take this opportunity to note where those muscles are on your own arm.
7. Now move your arm and observe what happens. How do the muscles expand and contract? Can you feel the same thing in your own arm?
Dissect a Bone

Materials:
large animal bone - a cow femur is ideal (ask a butcher) but you could use the bone from cut of meat such as a turkey leg or a leg of lamb or even a chicken bone - just be sure it's a whole bone, not a bone split open, such as the bones you'll find in some cuts of steak
sharp knife
small spoon
magnifying glass or loupe
pen and paper or science journal

Why: The basic structure of bones is similar for different species. See what the inside of a bone looks like and note that bones are living when they're in our bodies.

Procedure: Depending on the bone you got, you may first need to remove the meat. If you do so, observe the tendons and connections. If you have a whole turkey or chicken, you'll see sockets for the leg bones. Once your bone is mostly cleaned, observe and draw the bone. What type of bone is it? Where was it on the animal? Next, an adult or an older student with good knife skills should use the sharp knife to split the bone open lengthwise. Observe the inside of the bone and draw it. Can you see that it's not a solid mass? Can you find the spongy bone, the cartilage, the compact bone, the bone marrow? Label them on your drawing. Finally, if you have a large enough bone, can you use the spoon to scrape the marrow from the inside of the bone?

Open-Ended and Long Term Activities

Bendy Bones

Materials:
jar
vinegar
clean chicken bone, a drumstick or thigh bone
water

Why: Your bones are hard in part because of calcium. If we remove the calcium, then a bone will become bendable. This experiment allows the vinegar to dissolve the calcium in a chicken bone. However, if you don't get enough calcium or don't exercise enough, then you can experience a less dramatic, but still important loss of calcium in your own bones.

Procedure: Observe the bone to make sure it's hard. Place it in the jar and cover it with vinegar. Then leave the jar for a week to see what happens. When you check the bone after a week soaking in the vinegar, the bone should become slightly bendable.
Stretch Out

Materials:
measuring tape or ruler
pen and paper or science journal

Why: Your muscles are flexible and can become more flexible by being stretched over time.

Procedure: Sit with your legs outstretched and reach for your toes. Can you reach? Record how far the tips of your fingers are from your toes or how far past they reach. Next repeat the procedure every day for two weeks. At the end of that time, can your fingers reach a little farther? How much?

Extensions: You can try this with other muscles stretches. For example, try it with splits or forward bends. If you can become more flexible in two weeks, what about two months? Does how long you spend stretching make a big difference?

Ideas for Your Journals


* While labeling the muscles is more detailed than most students will need, you can also find several label the muscles worksheets online. Try this one: http://www.biologycorner.com/anatomy/muscles/label_body_side.html

* You can draw the different types of joints, or you can look for a worksheet. Try this one: http://www.kbteachers.com/human-anatomy/bone-joints-printable.html

* You can draw a diagram of the parts of a bone, or you can look for a worksheet. Try this one: http://www.kbteachers.com/human-anatomy/bone-anatomy-worksheet.html

* Several of the activities above include journal sections. If you dissect a bone, be sure to draw your dissection.

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